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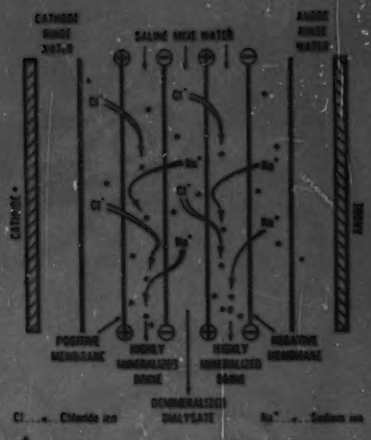


GOLD MINES in Orange Free State are desalting underground water for plant re-use. p 84

MYRIAD USES are developing with new aerial techniques of mapping, siting, and searching for ore. p 77

NWMA looks at the challenge of new situations, low prices and increased costs. p 100

FLOTATION on the Mesabi goes commercial. p 90

ALSO IN THIS ISSUE: Blasting symposium at the Missouri School of Mines p 106 . . . . . Metal & Thermit's new rutile plant p 94 . . . . . New E&MJ format — see contents p 2

The new look

IN SLURRY PUMPS

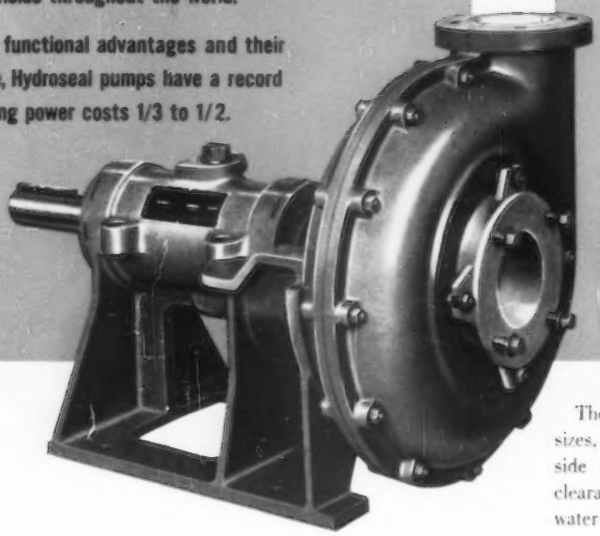
Efficiency with economy through Hydrosealing

Deliver pulp UNDILUTED

HYDROSEAL

THIS split-shell version of the old Hydroseal Slurry pump is a new companion of Hydroseal Sand and Hydroseal Dredge pumps—famous for superior service in mining fields throughout the world.

Besides functional advantages and their long life, Hydroseal pumps have a record of cutting power costs 1/3 to 1/2.



CENTRISEAL

THIS industrially-efficient complement to the Hydroseal Slurry is meeting enthusiastic acceptance where abrasive, corrosive pulps must be delivered undiluted

. . . uranium mining
. . . ore beneficiation
. . . fertilizer producing
. . . cement manufacturing
. . . wherever they pump
nasty corrosive slurries.

These rubber-lined Slurry pumps are made in seven sizes, each identical except their impellers and engine-side shell half-liners. In the Hydroseal, the close clearances are protected from abrasives by sealing water; in the Centriseal, by impeller auxiliary vanes.

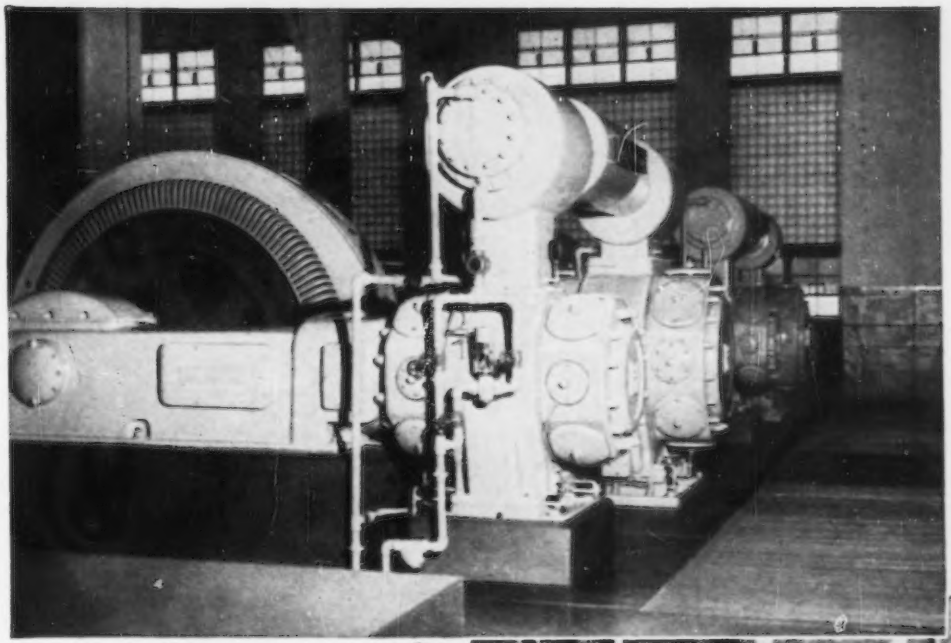
The vast experience of our engineers is at your disposal. Write us about your pumping problem.

THE ALLEN-SHERMAN-HOFF PUMP CO.
Dept. B—259 E. Lancaster Ave., Wynnewood, Pa.
Representatives throughout the World

HYDROSEAL *and* **CENTRISEAL**
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

ON TOP or DOWN UNDER

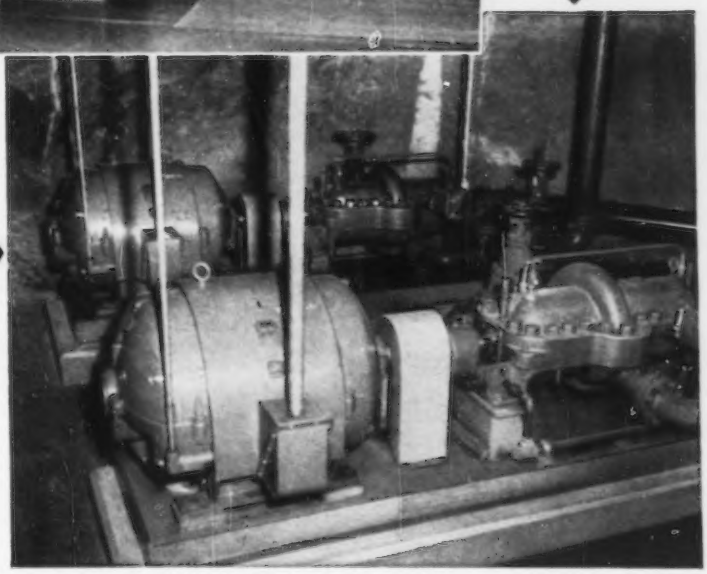
Pumps and Compressors give TOP LEVEL PERFORMANCE at Large Underground Iron Mine



These two Ingersoll-Rand PRE compressors, installed at ground level of this large underground iron mine in the midwest have been giving dependable, trouble-free service for over six years. Each unit is rated 600 hp, 3190 cfm, delivering 100-psi air for operation of rock drills, air hoists and pneumatic cylinders throughout the extensive underground operations.

Installed way down at the 17th level, three Ingersoll-Rand CNTA pumps force mine water up to the surface. These automatically-controlled units, two of which are shown at the right, are driven by 250-hp motors and handle 600 gpm at a total head of 1300 ft.

Other Ingersoll-Rand pumps in use at this iron mine include a 800-gpm fire protection pump and three 600-gpm close-coupled Motorpumps circulating cooling water to the compressor, oil filtering system and electrotype step regulator.



FOR INFORMATION on mine pumps, compressors, rock drills, air tools, and hoists to meet your exact requirements to best advantage, call your I-R representative or nearest branch office.

Ingersoll-Rand

10-654 11 Broadway, New York 4, N. Y.

COMPRESSORS • GAS & DIESEL ENGINES • ROCK DRILLS • PUMPS • TURBO-BLOWERS • AIR & ELECTRIC TOOLS
CONDENSERS • VACUUM EQUIPMENT

MAXIMIX RUBBER, PROTECTED

ENGINEERING AND MINING JOURNAL

92nd YEAR OF PUBLICATION

JANUARY 1958

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B.F.Goodrich report:

Extra-tough hose for rugged jobs is also light, easy to handle

THAT hose carries air and water to a drill, breaking up chunks of ore in a lead mine. The hose is dragged across sharp, abrasive rock. It's twisted and bent. It's subjected to hot air from the compressor. Such abuse would shorten the life of most rubber hose. But not the B.F.Goodrich Commander air hose pictured here.

The cover of this B.F.Goodrich air hose is made with a tough, oilproof rubber. It stands rough treatment, has high resistance to scuffing, cutting, gouging, tearing. Special wire-braid reinforcement makes this hose stronger, tougher—helps it take higher pressures, provides a greater safety factor.

The lining of B.F.Goodrich Commander air hose is made with a special rubber compound that stands hot air, won't harden, crack, or break into gummy particles to clog tools. Strong and rugged as this air hose is, it is still light enough to be carried around without effort, extremely flexible so that it handles easily, doesn't tire workers.

Where to buy: Your B.F.Goodrich distributor has exact specifications on the B.F.Goodrich Commander air hose. And, as a factory-trained specialist in rubber products, he *can* answer your questions about *all* the rubber products B.F.Goodrich makes for the mining industry. *B.F.Goodrich Industrial Products Company, Department M-257, Akron 18, Ohio.*

B.F.Goodrich

INDUSTRIAL PRODUCTS

Behind the By-Lines...

A number of surveys have shown that a segment of the magazine-reading public starts a book on the back page and works forward. Other studies have proved that some people rarely consult the contents page. If you belong to either of those groups, you're probably not reading this page right now.

E&MJ has had a face-lifting. We've moved our "late form" closer to the front of the book. There you'll find the editorial, outlook, late news, and a bigger and better markets section. It starts on p 17.

The new products section, too, has a new address. —And it's printed on colored stock, as well, for your convenience. It's easier to find and there are more items to be found there. See p 41. We hope you'll find the whole thing livelier and easier to read.

In November, we told you we were presenting a "people" issue. The December effort turned out to be a "flow-sheet" issue. (We didn't tell you that on this page, but if you'd called and asked, we'd have mentioned it. It was the talk of the shop.)

In January, the proper handle could well be "the meetings issue." We've got 'em, from the blue Pacific to the wide Missouri, plus a report from the Mile High City.

One of the pleasant sidelights of the Northwest Mining Association meeting in Spokane (page 100), was the greeting and welcome offered by Suzanne Thompson, Miss Spokane, 1957. The lovely young lady described her Indian costume to the delegates and finished by noting that her one-feather headdress indicated that she was an Indian maiden. When she married a brave, she would wear two feathers. Karl Jasper, president of the association, spoke for most of the group when he followed Miss Thompson's speech with, "Oh, for those one-feather days again!"

At the Missouri Symposium (page 106) ammonium-nitrate blasting was the main topic. However, there were other subjects. In fact, we had to forcibly restrain one editor from leading off the report of the sessions with a full description of the quality of the coffee-break doughnuts served by faculty wives.

But our man apparently succeeded in tearing himself away long enough to get the story.

Submitted with it, in true Stanleyan style, was the following:

"Prior to formal meeting many in attendance took part in a small briefing on earth satellites by John S. Rinehart, of the Astrophysical Observatory, Smithsonian Institute.

"Said to self, 'Why a satellite man at a drilling and blasting symposium?' Found out that in pre-sputnik days, Rinehart did classic report on impact fracturing of metals. Most enjoyable time; no doughnuts served, but enjoyable.

"Now about those doughnuts. . . ."

While all was not unconfined joy at the Denver meeting sponsored by the Uranium Institute of America and the Chamber of Commerce of the U. S., our Plateau friends found that, although they're in a spot . . . they've got nine years to get out of it.

Donald H. McLaughlin of Homestake said, "I'm an optimist." And he can prove it. Homestake has a sizeable chunk in two solvent extraction mills going up at Ambrosia Lake, N. M.

A little more than eleven years ago, *E&MJ* published a story on the aeroplane in mining, wherein we did some limb-walking-out-on. We're happy to report that it has turned out to be a very comfortable limb with an excellent view. The talented lads who fly, navigate, read maps and geigers (and, for all we know, Plutarch's *Lives*) simultaneously have more than proven the worth of aerial surveying.

That happy report we mentioned contains case histories of orebody locations, highway and railroad layouts, and the many other jobs that the fly boys do so well. It starts, through the pleasant cooperation of Aero Service Corp., on page 77.

International Nickel Co., Inc. is keeping tabs on more than new prospects and the current market situation. Latest product of their research contained some information we found interesting:

The early history of nickel has been rolled back some 4,000 years as the result of research findings presented in a paper published in the current issue of the *American Journal of Archeology*.

"Whereas nickel's known uses had previously dated from about 170 B. C. when a cupro-nickel coinage was developed in the Kingdom of Bactria, the research paper brings the history back to the ancient civilizations of Sumeria, Syria and the Indus Valley. Nickel, the paper notes, is now known to have been present in significant amounts in certain bronze tools and implements made almost 6,000 years ago."

And, the authors point out, use was very probably not the result of similar occurrence, but the inclusion of nickel was deliberate on the part of the tool maker.

Our old friend the beachcomber has muttered for years about the pressures of group living and the threat to what he calls "the irrefragible me." We hadn't paid too much attention until his 1956 income tax form was returned.

Seems he panicked someone at headquarters by writing in the space marked DO NOT WRITE IN THIS SPACE.

All right, men. Back to the contents page! Or, as Lawrence Welk, the Mantovani of the Midlands, would say . . . "An'-a-one, an'-a-two. . . ."

BACKGROUND:

In 14 years of strip mining, the Dulin Bauxite Company, Inc., contracted for dirt removal. The company studied contractors' production records, types of equipment used.

RESULT:

Last year, when the Dulin firm bought its own equipment, it selected Caterpillar-built machines exclusively.

The picture above shows how the firm is using the equipment at its bauxite strip mining operation near Little Rock, Ark. In this pit some 300,000 yd. of overburden are being removed at the rate of 4,200 yd. per day by 3 CAT* DW21 Tractors with No. 470 LOWBOWL Scrapers, push-loaded by a mighty D9 Tractor.

Here is the result of experience in action—and doing fine! Says L. D. Riffe, vice-president of the firm: "We find that this method of moving dirt is the best from the standpoint of high production and economy."

There are plenty of good reasons why these rigs are the best method to move dirt. The DW21-No. 470 combination has the capacity for big-volume hauling—18 cu. yd. struck, 25 cu. yd. heaped. But more important than capacity, the No. 470's LOWBOWL design has greater loading efficiency than any other make of scraper in its class. Actual tests show that the No. 470 gets its rated capacity load and is on its way while other scrapers are still in the cut, struggling for the last few yards. And when it has its big load, the 300 HP (maximum output) DW21 moves it at high speeds, efficiently.

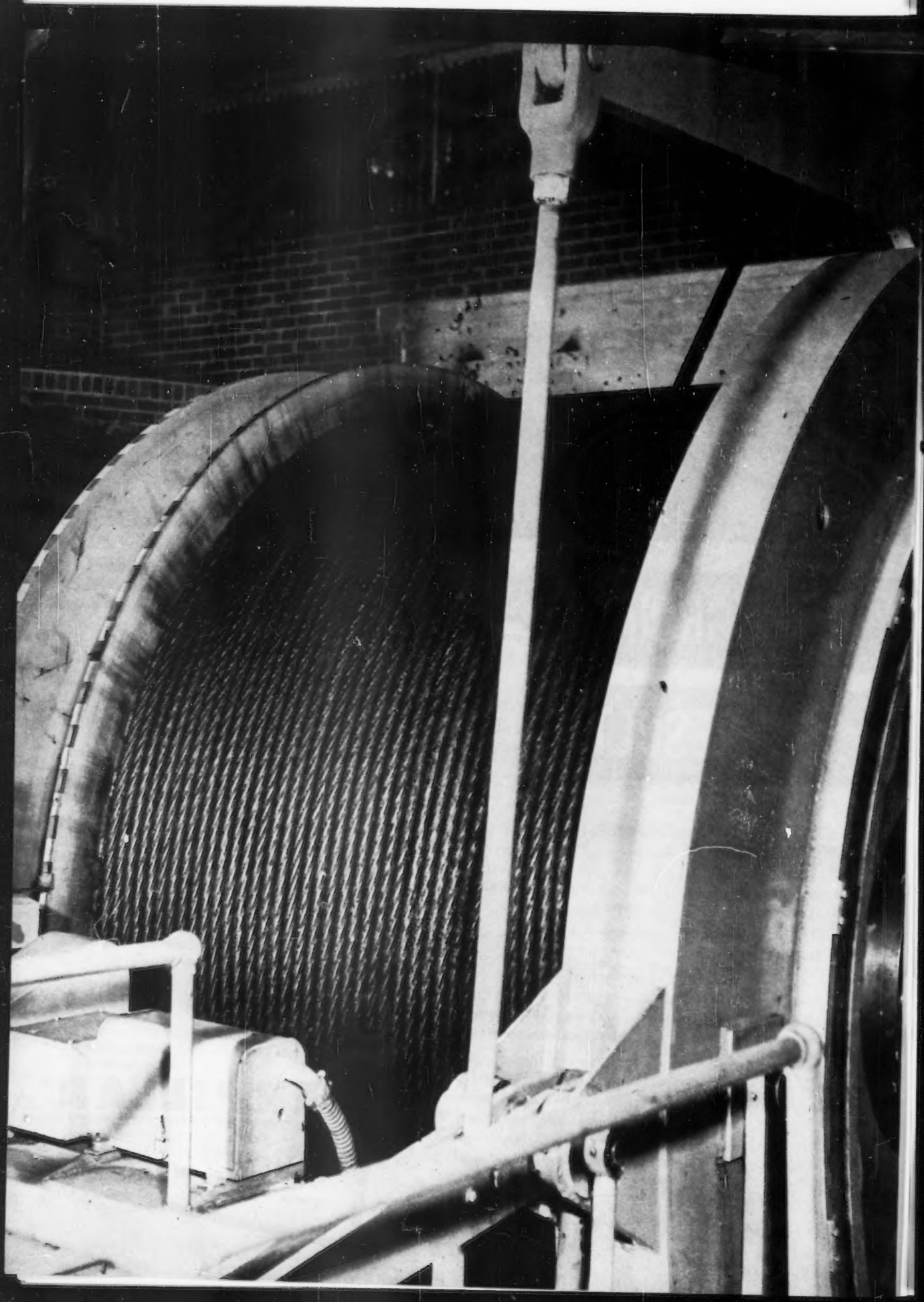
Let your Caterpillar Dealer show you how these rugged rigs can move material faster and cut costs in your operation. You can depend on him for sound advice now—for fast service and parts you can trust after you buy.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

**WANTED—
THE HARD WORK**



ON OPEN GEARS . . . Texaco Crater cushions gear teeth against shock and heavy loads. It acts to prevent wear. (Use Texaco Crater X Fluid where spray application is more advisable.)

MINE CLOSEUP

Here's Texaco Crater in action . . . As the wire rope flexes under load, Crater's protective film stays firmly in place, sandwiched between the metal surfaces of the wire strands

This is how a superbly specialized lubricant acts to preserve the strength of wire rope:

. . . Crater penetrates the rope and seals the core

. . . it then issues itself over each strand and separates them with a sturdy film, thus reducing internal and external friction—and wear!

Because Texaco Crater adheres so tightly to metal, its protective film becomes as one with strand surfaces. Thus, it provides an impenetrable barrier to rusting and corrosion.

There are many ways to improve the efficiency of your mine equipment. A Texaco Representative will be glad to sum them up for you in one of Texaco's famous Simplified Lubrication Plans, designed especially for your mine. Call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

FOR MINE CAR BEARINGS . . . Your Texaco representative will include Texaco Olympian Grease in your Simplified Lubrication Plan. It seals dirt and moisture out of mine car bearings and assures fast, easy starts even at winter temperatures.

TUNE IN . . . Metropolitan Opera Radio Broadcasts Every Saturday Afternoon

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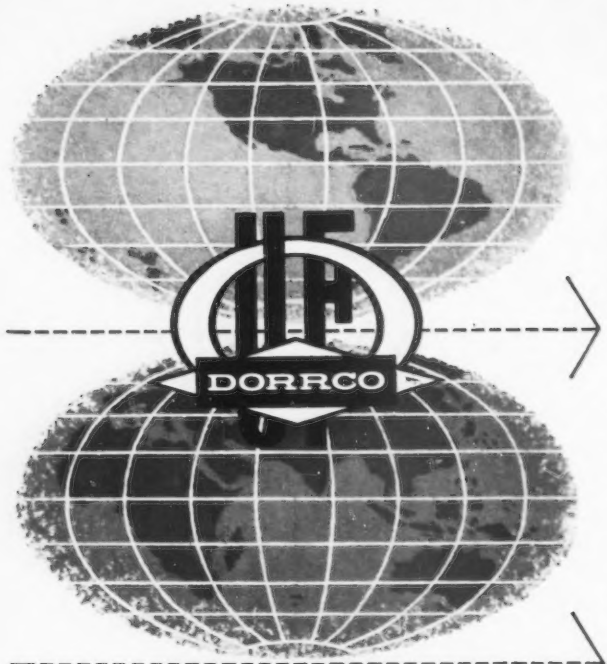
(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)



1957 has been a year of contrasts.

Significant advances in technology, the completion of a substantial portion of our program to expand our productive capacity in the U. S. and Canada and the strengthening of our marketing organization are all tangible achievements which will bring us both immediate and long-term benefits. On the other hand, a generally lower activity in new projects coming in has emphasized the narrowing profit margins faced by most businesses and points up our insistence on improving designs, reducing costs and increasing efficiencies.

Abroad, the picture is bright. Our subsidiaries report current high levels of business and there is great optimism for the future. Of particular interest is the success of our newest family member, Dorr-Oliver Pty. Ltd. of Australia, which opened its doors on January 1 of this year and by mid-year had far surpassed expectations. Growth of Dorr-Oliver (India) Ltd., another of our newer associates, has also been noteworthy, with the recent addition of local manufacturing facilities justifying still greater optimism.

SUGAR — In 1957 a total of 42 RapiDorr Clarifiers and 48 Oliver-Campbell Cane Mud Filters were sold to the cane sugar industry. A significant aspect of this outstanding record has been the increasing participation of our subsidiaries and representatives abroad. They are locally manufacturing, in some instances for the first time, 31 of these machines in Argentina, Brazil, England, France, Germany, India, the Philippines and South Africa.

POLYETHYLENE — The first Merco Pressure Centrifuges went into operation early last year removing catalyst from liquid polyethylene at capacities considerably in excess of original expectations. Overseas, British, Italian and German producers ordered Pressure Centrifuges for similar application in both new commercial scale and pilot plants.

SANITATION — One of the highlights of the year was D-O activity in the waste water disposal field. Four major new developments—all ideally suited for smaller plants—were introduced. The SpiroVortex System which is a complete treatment process akin to activated sludge, the Degritting Clarifier and Clarigester and the DorrClone Classifier as applied to sewage degritting have already been commercially proven at plants in the western U. S. First installations of the CompleTreator, a package plant to serve a population of 150, are now operating with some 30 additional units scheduled to start up in 1958.

Our subsidiary in the Netherlands has marketed equipment for facilities as far distant as Norway, Iraq and India, while new or enlarged D-O equipped domestic installations sold in 1957 can be found from New York City to Los Angeles and San Antonio, Texas to Fairmont, Minnesota.

GENERAL METALLURGICAL — Applications of the DSM Screen, first introduced in 1956, continued to grow in virtually every field we serve. One of the most promising has been magnetite recovery in heavy media cyclone plants on the Mesabi Range. Also new is the swing-type agitator for the American Filter — a development particularly applicable to filtration of heavy metallurgical slurries.

Following the trend noted in previous years, widespread acceptance of the Slurry Mixer by the cement industry and the Thickener — American Filter combination by the coal industry continued again last year. In Germany, France, India and Australia flue dust clarification and recovery contributed materially to our business and in Canada a substantial volume of Dorr-Oliver-Long shaft equipment and mine cars was purchased for underground mines.

PLANT ENGINEERING — At the year's end, design of a granular fertilizer plant for India and sections of a new Cuban nickel recovery plant were partially completed, and construction of three D-O designed phosphoric acid or fertilizer plants was progressing in Venezuela, England and Montana. During the year a 200,000 ton per year triple superphosphate plant in Florida and a Norwegian phosphoric acid installation were put into operation and brought up to design capacity in near record time.

FLUOSOLIDS SYSTEMS — Also in the fertilizer industry two western producers ordered the first FluoSolids Systems to be used for calcination of phosphate rock. Designed to handle a total of 1,500 tons per day, these installations were the direct result of successful field tests using a portable fluidized bed pilot plant. During the year other FluoSolids Systems were ordered to dry limestone and blast furnace slag in the U. S., roast copper matte in Belgium, calcine clay in Scotland, decompose copperas in England, and roast pyrite for a Japanese paper mill and an Italian sulfuric acid manufacturer.

The largest FluoSolids System for fine coal drying, handling over 600 tons per hour, went into operation during the third quarter at a new eastern preparation plant, and construction is nearing completion on a second similar, but smaller, installation. In the realm of unusual applications is a unit drying a highly-corrosive chlorinated hydrate at an eastern chemical plant.

PETROLEUM — Another modification of the familiar DorrClone Classifier is the ClayJector, latest development for control of drill mud weights. Noteworthy economies are possible using this unit which mechanically rejects undesirable drilled solids while recovering valuable barites for reuse.

PULP AND PAPER — Another operating "first" recorded during the past year was initial operation of the first complete D-O Pulp Bleaching System. Located at a northern New York state mill, it is the result of an extensive program to develop a new and improved continuous bleaching system for the pulp industry. Abroad, the Swedish representative of our Dutch subsidiary has just completed an outstanding year marked by one of the largest orders in their history for Bleach Washers and by orders for a number of new or expanded Recausticizing Systems.

WATER TREATMENT — In the southwestern United States the DorrClone Classifier has been used with notable success for the desanding of municipal well water supplies. For small plants the PeriFilter System with a single pre-treatment unit and split filter provides economical unitized water treatment.

Major expansions of the Louisville, Kentucky and Fort Worth, Texas treatment facilities will be D-O equipped as will new municipal plants at Springfield, Ohio; Peoria, Illinois; and Delhi, India. New industrial treatment installations will serve pulp mills in South Carolina, India and Venezuela and an Indian fertilizer plant.

CHEMICAL — A substantial amount of D-O equipment of all types has been incorporated into the unique flowsheet of a new astrakanite recovery plant in the Chilean nitrate fields. In Germany and the United States, Horizontal Filters have been widely applied to dewatering and washing of fine organics as well as highly corrosive inorganics, and around the world filters of both standard and special construction were ordered for an almost endless variety of services.

FOOD PRODUCTS—A mid-western producer has ordered twelve centrifugals of three basic types for washing and concentrating soya protein solids. Last year the largest U. S. corn starch producer put into operation a Merco-DorrClone starch washing system, and in 1958 the first DorrClone germ separation station in the same industry will go on stream. Also in centrifugals, a smaller model of the Mercone Screening Centrifuge is now available for intermediate or small scale operations.

COPPER AND URANIUM — Last year substantial amounts of D-O processing equipment were purchased for new and enlarged copper mills in South America, Mexico, the Belgian Congo and United States and new uranium mills in Australia, United States and Canada. A new and improved design and method of fabrication of stainless steel rake Classifier blades was developed. Although conceived initially for the uranium industry this design is broadly applicable to classifications involving corrosive solutions. Certainly no summary of 1957 accomplishments would be complete without mention of the Chemical Engineering Achievement Award presented last month to a group of companies including Dorr-Oliver for their contribution to extractive metallurgy of atomic age metals. Interestingly enough, D-O was one of the very few engineering equipment organizations selected for the award.

With several years of expansion and enormous activity behind us, the current business plateau provides a much needed opportunity to consolidate and catch our breath. The real challenge will be to increase the spread between income and outgo through more efficient operation — while accelerating the rate of our technological advances. I am confident we can, and will, do both.

J. D. Hitch, Jr.
President

November 18, 1957

FluoSolids, DorrClone, PeriFilter and RapiDorr T. M. Reg. U. S. Pat. Off.

NEW SLIDE RULE

Free

gives you CRUSHER CAPACITIES and a SCREEN ANALYSIS of the crusher product

● For the first time—a handy slide rule with all the information you need to select the right crusher or crushers for your particular requirements. It gives the capacity for all sizes of Telsmith Jaw, Gyratory, Gyrasphere, and Intercone Crushers. It shows a Screen Analysis of the product from each of these crushers when set with any proper discharge opening. It will help you pick and buy the best and most economical type and size of crushers for your aggregate plant, or mill. No more reading complicated charts or tables. Here's all you need—in quick easy-to-read form.

HOW TO GET YOUR SLIDE RULE

Call at the Smith Engineering Works Booth at the Sand and Gravel or the Crushed Stone Association Convention at Chicago in February—sign a card and your free slide rule will be mailed to you . . . or, a request to Smith Engineering Works, Milwaukee 1, Wis., on your letterhead, stating your position, will bring you a slide rule with the compliments of Telsmith.

SR

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502 E. CAPITOL DRIVE **MILWAUKEE 1, WISCONSIN**

Representatives in Principal Cities in All Parts of the World • **Cable Address: Sengworks, Milwaukee**

Look for this nearby Goodyear dealer sign for better tire values —better tire care.

GOODYEAR TIRES

In the mountains of Guatemala, the last links are being forged in the 3,179-mile right-of-way from Texas to Panama. Landslides (as shown below) are the order of the day—but early in '58, the first wave of American tourists is due to swap dollars for blankets, bananas and local color! Two ten-hour shifts push the work forward, and Goodyear tires—Hard Rock Lug, Sure-Grip Lug and All-Weather Earthmover—help keep the job rolling, faster, surer and at lowest cost-per-mile.

Watch "Goodyear Theater" on TV—every other Monday 9:30 P.M., E.S.T.

Tires move more yards for less

when built with **Triple-Tough 3-T Nylon Cord!**

ALL 3-T NYLON CORD—*Tubeless or Tube-Type*

HARD ROCK LUG | SURE-GRIP LUG | ALL-WEATHER EARTHMOVER

Like steel, tire cord must be *tempered* to be tough. Goodyear's exclusive 3-T process, involving Tension, Temperature and Time, *triple-tempers* cord to make it TRIPLE-TOUGH—to give you longer tire life, lower cost-per-mile.

Known as *"the greatest tire SAVER in 23 years,"* Triple-Tough 3-T Nylon Cord is a Goodyear exclusive.

During years of use, on the toughest jobs on earth, Goodyear 3-T Nylon Cord tires have literally saved *millions* for contractors and truckers who realize that the final cost of any tire depends entirely on *what they get out of it.*

The fact that more tons are hauled on Goodyear tires than on any other kind, certainly suggests that most operators get more yards-per-dollar, more miles-per-dollar, on Goodyears. If *you're* not already using Goodyear 3-T Nylon tires on your equipment, try them! Goodyear, Truck Tire Dept., Akron 16, Ohio.

Buy and Specify

GOODYEAR

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

All-Weather, Sure-Grip—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

call KE for plant expansion or new facilities
call KE for plant expansion or new facilities

INGENUITY

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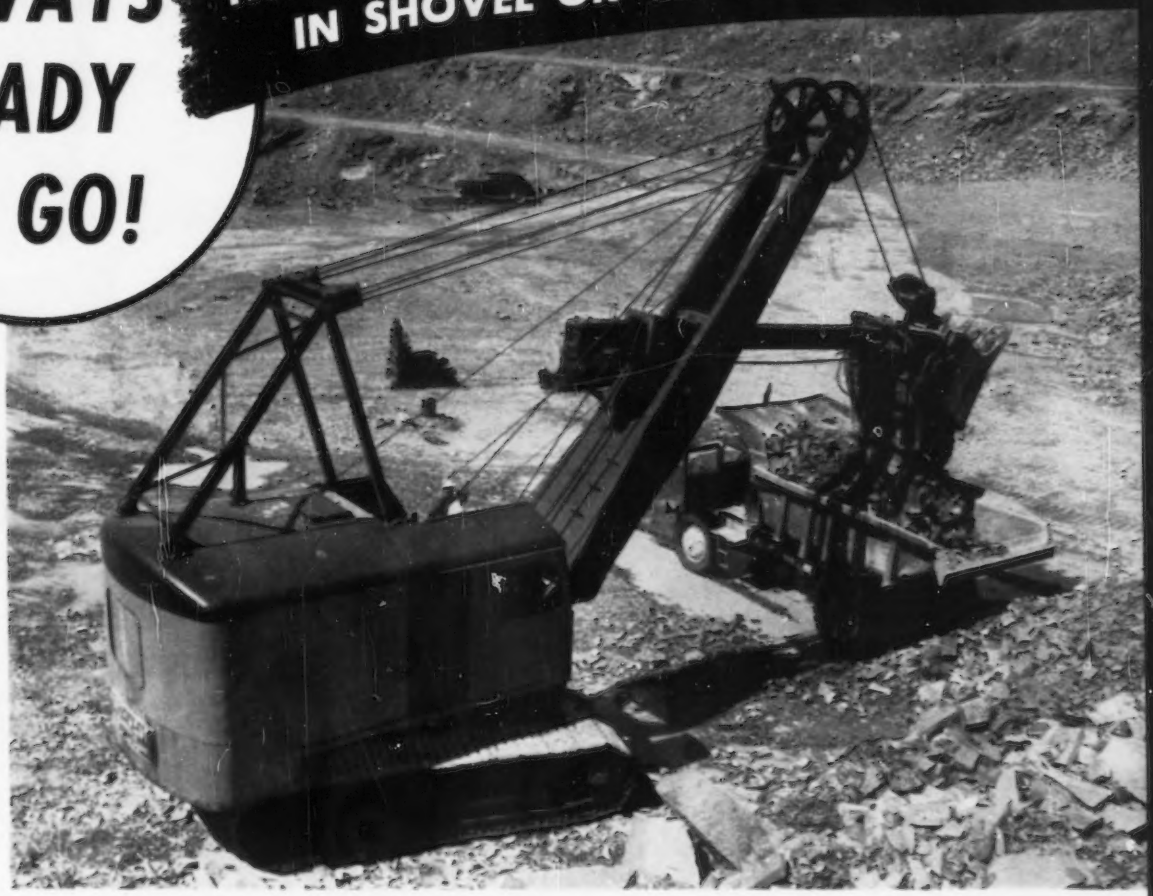

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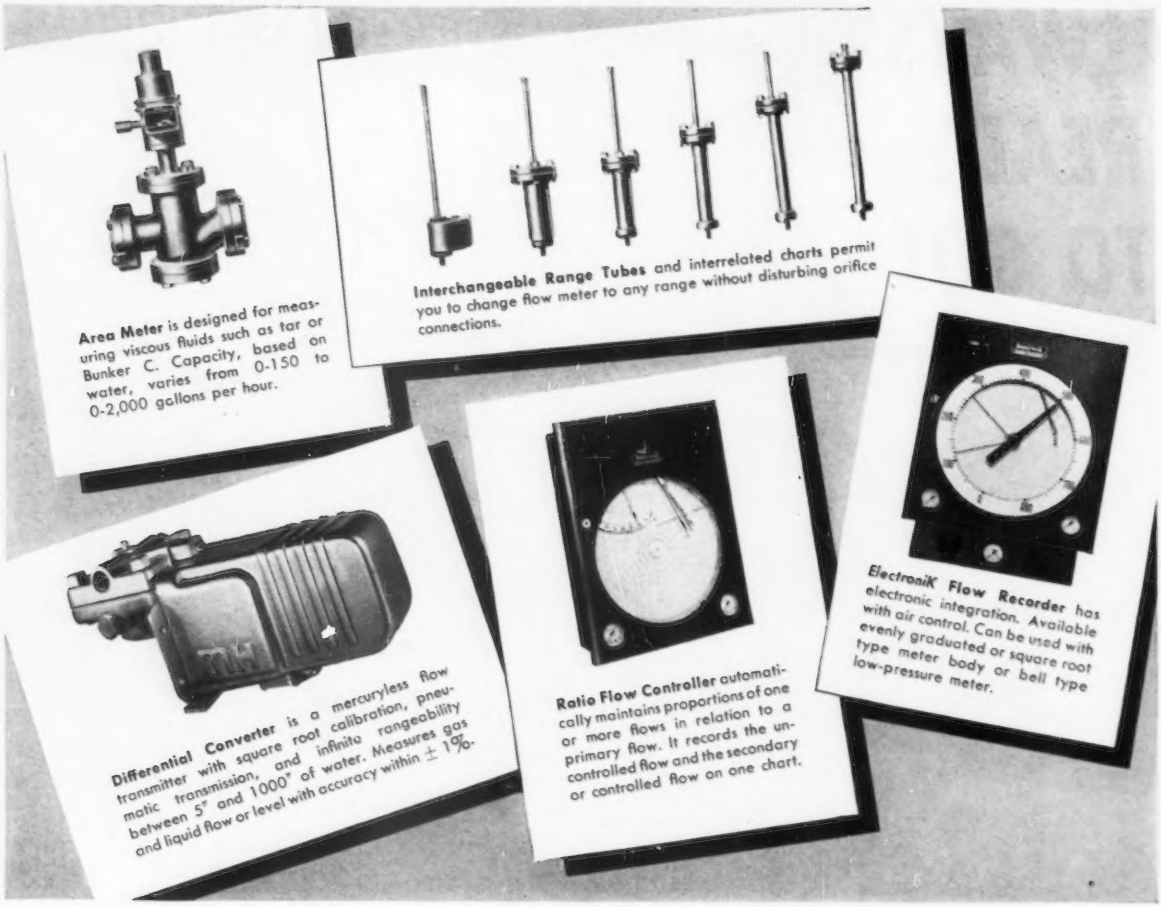
Area Meter is designed for measuring viscous fluids such as tar or Bunker C. Capacity, based on water, varies from 0-150 to 0-2,000 gallons per hour.
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ElectroniK Flow Recorder has electronic integration. Available with air control. Can be used with evenly graduated or square root type meter body or bell type low-pressure meter.

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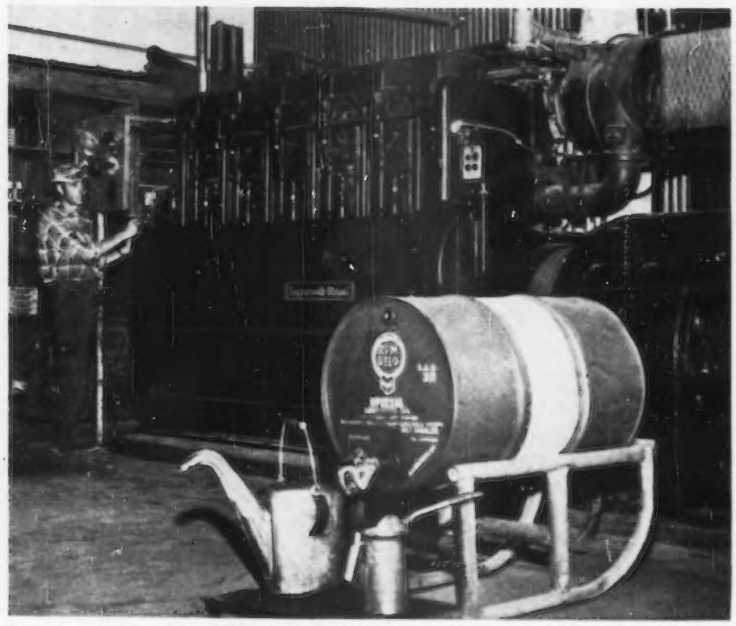
ENGINEER'S FIELD REPORT

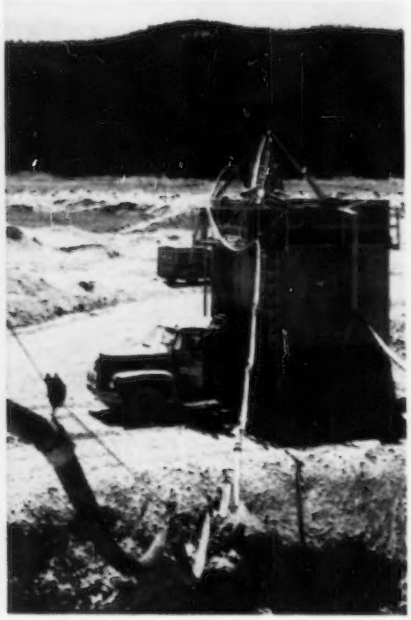
PRODUCT RPM DELO OIL

FIRM PORTER BROTHERS CORP.
Bear Valley, Idaho

Operates 7,000 hours without measurable wear



Lubricated with RPM DELO Oil, this 650-hp Ingersoll-Rand diesel is still in nearly new condition after three years' service. "We found no carbon sludge or lacquer when we tore it down last winter," says Power Plant Foreman Bill Niece (above). "And there was no measurable wear on rings, liners or bearings, though it had run more than 7,000 hours!" Engine is in power plant of Porter Brothers Corp. Firm dredges for strategic minerals under government contract.



Trucks hauling firm's ore work 'round the clock, 9½ months a year. Despite the tough punishment of carrying heavy loads over unpaved mountain roads, RPM DELO Oil keeps engines running smoothly, and eliminates excessive wear.

Giant dredge (left) processes nearly 6,000 yards of gravel every 24 hours. "Both this and our smaller dredge depend upon our diesel-generators for power," explains Superintendent Clay La Fon (right). "That's why we do everything possible to keep them running properly...and that includes using RPM DELO Oil. We've had excellent results with it in all our equipment...in our power plant, in our trucks, and in the tractors that level our tailings and restore the areas we've worked."

Why RPM DELO Oils reduce wear—prolong engine life

- Oil stays on engine parts—hot or cold, running or idle
- Anti-oxidant resists lacquer formation
- Detergent keeps parts clean
- Special compounds prevent corrosion of bearing metals
- Inhibitor resists crankcase foaming

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ENGINEERING AND MINING JOURNAL

JANUARY, 1958

A Plea for the Little Fellow

IN OCTOBER 1951 *E&MJ* published an article on the Greater Butte Project in Montana, and with it an editorial entitled "Men on a Hill," which commended the Anaconda Copper Mining Co. (now The Anaconda Co.) for having the "courage and vision to launch this expensive development." Subsequently, Anaconda ordered reprints of the article and requested that the editorial page be included in the reprint. Since the editorial page also ran an unrelated editorial, "Don't Kill the Little Fellow," the editors naturally asked whether the second editorial should be deleted. The answer was "No, run that editorial too, 'Con' Kelley likes it."

Now what was there about the second editorial that met with the approval of the late Cornelius F. Kelley? In essence, it expressed deep concern that the trend of labor-management relations in the nonferrous metal mining industry toward industry-wide bargaining would victimize new, small, and high-cost operations. The editorial said that blue-chip operations could be expected to pass added costs on to the consumer, but that the small, high-cost producer enjoyed "no such preferred status."

The editorial implored those members of industry who have a hand in labor negotiations to "strive desperately to tie collective bargaining to local problems," in lieu of industry-wide bargaining.

We infer, accordingly, that Mr. Kelley's interest in the editorial meant that he considered "the little fellow" vital to the mining industry, and that it was the obligation of the big mining companies to look out for the little fellow in some respects.

If this assumption is correct, we are again passing through a period in which the big fellow can be really big but in a somewhat different manner.

The current threat to the entire mining industry is a temporary overproduction of base metals and a modest one at that. It's the big fellows who can trim production conservatively, but it's the little fellows who go by the board when prices plunge as a result of overproduction. And as the prices drop lower and lower, some bigger "little fellows" will start to drop out.

Admittedly, the trimming of production cannot be collusive, and there are impediments to succinct cutbacks, particularly on a world-wide basis. Chile, for instance, which depends heavily upon copper revenues, finds it hard to accept the fact that a moderate cutback in volume would be beneficial to its economy in the long run. The same is true of some large African producers.

This editorial is not written to point the finger of criticism at any nation or producer, but rather to call attention to the plight of the small producer who has been a victim of a slight but persistent overproduction of metal which has done neither the large nor small producer any good. We believe that the "little fellow" is vital to the mining industry. In the long run, we need the metal that he mines to supplement that produced by the big fellow, and to feed the custom smelters of the world with concentrates. It's the "little fellow" who often makes the important mineral finds, and as one of our friends at Anaconda says, "We need people like that in the mining industry who are pushing the bushes apart in the wild country looking for bonanzas."

Some mining men hold that, regretful though it may be, we are undergoing a necessary process of weeding out the men from the boys. This might be a sound viewpoint if all ore deposits were equally rich, and if the high-grade deposits came even close to supplying the world's long-range demands. But since we need the production of the high-cost mines in times of scarcity, it seems reasonable to be mindful of the survival of these producers in intermittent times of surplus. Furthermore, if we weed out all the producers who have Government purchase contracts; fast write-offs; who ship to stockpile; or who have received RFC, DMEA and Export-Import Bank assistance; we find that we have very few "men" left in the industry.

We suspect that one of the barriers to making the foregoing ideas workable in the mining industry is the fact that (some) non-mining members of boards of directors of mining companies, and stockholders who cannot see beyond the quarterly dividend will take the position that the "little fellow" is expendable. In the automobile business, this might be true, but in mining, which is essentially a long-range business, we must still hold out for the "little fellow."

MARKETS

All Nonferrous Sales Low; Copper Output Cut; Barter Increase Doubted

DECEMBER NONFERROUS METAL PRICES dropped to 174.42 from 175.46 owing mainly to the drop of ½c in lead and a slight drop in copper and silver. A rise in tin of about 3c a lb did not offset the price declines.

Copper ended the year pessimistically. Sales reported to *E&MJ* for copper in the U.S. in December were the lowest of the year except for July. Sales of refined copper in the U.S. (as reported by the copper statistical organization) for delivery in December and in January were much under comparable figures for other months of 1957. Sales and shipments of fabricated products late in the year were exceptionally low. Activity in the copper industries outside the U.S., though not down as much as in the U.S., showed some hesitancy.

London copper averaged in December £181.431 (mean of the prompt bid and asked); this is down about £6½ from the November average. It reached a new low of £176 for prompt bid Dec. 11. It bounced to £188½ Dec. 16 owing to reports (some of which were true) of output cuts and actual heavy buying on the LME by an African producer. By late Dec. 17, all U.S. custom smelters had raised to 25½c. As the month ended, sales of copper were exceptionally slow and some observers thought the 25½c price might not hold. Dealers were undercutting it in the U.S. by about 1c. Katanga ended the year at 22.395c for Europe and the U.S.

Production cuts were announced in December. Kennecott's subsidiary, Chase Brass, indicated it would further reduce operations at the smaller of its two Waterbury, Conn. plants—it will close it by spring (it has 750 workers in the plant). Most interesting to the producing industry was Kennecott's announcement it would reduce mine output by about 12% in the U.S. This is about 3,800 tpm. Facilities in Utah, New Mexico and Nevada will operate for 12 days and close for two days. An official of the firm said lack of demand in the U.S. caused the decision. Howe Sound is cutting its British Columbia output from 750 tpm to 450 tpm. Some help from the Canadian and British Columbia governments prevented the firm from closing. Cerro de Pasco is reducing output by about 325 tpm.

A major U.S. daily financial newspaper reported in mid-December that reports from abroad were that Katanga had recently quietly initiated a 10% cut in output. Katanga replied that it had made no such report but that it was contemplating a reduction in 1958. It said it had reduced 1957 output relative to 1956. As the month ended, there again were rumors Chile would permit the copper companies there to cut by 10%. Certainly, some of the persons in the Copper Dept. seem in favor. But some observers believe if the workers' work period is reduced in Chile trouble for the government might develop.

Meetings early in December between representatives of various copper producers, including Katanga Rhodesian producers and the Chile Copper Dept., apparently produced nothing. White Pine Copper Co. late in December was authorized to ship copper to the U.S. Government under its expansion "put" contract. Most believe over 3,000 tpm is involved. Apparently the price is 28½c, though it is not settled if this is delivered or f.o.b. Since White Pine is not near delivery points, this can make a considerable difference.

Lead sales in the U.S. in December probably reached the lowest level in years. Reports to *E&MJ*, from which weighted average prices are calculated, were even lower than in November. The industry statistical organization reported sales for November of 42,051 tons; for October it was 58,012 tons. Shipments in November, reported by the American Bureau of Metal Statistics, were 32,193 tons to consumers, and 4,745 to others, presumably the U.S. Government. In October they were 40,447 and 7,235 tons.

GSA accepted late in December about the usual amounts of lead. London ended the year at about 9⅛c, about 3⅞c under N.Y. This differential is about what most factors believe would be required if the U.S. raises its import duty to 2.55c, the maximum permitted. Many now feel the duty increase will be postponed for several months. They also suggest it might not effect the U.S. price. Reductions of output have been occurring outside the U.S. and within.

Zinc sales reported to *E&MJ* in December were the lowest in years. Shipment figures for November were slightly better than for October. GSA accepted about as much zinc in December as in previous months—it is for delivery by mid-February. London was about 7⅞c the end of the month. This is about 2½c under the U.S. price. If this differential were maintained and the tariff were raised to the maximum permitted, 2.1c, some sources of zinc for the U.S. would be cut off. High Grade and Special High Grade, which sell in Europe at very low premiums, are now available in the U.S. at considerable discount. Sales made in the U.S. at the regular premium are at 11.75c; some sales are being made at 11.50c. Dealers report they can buy Special High in Europe at about 8½c; about 2c can cover freight, duty, insurance and the dealers' margin when shipped to points near U.S. ports.

American Zinc Institute data, short tons:

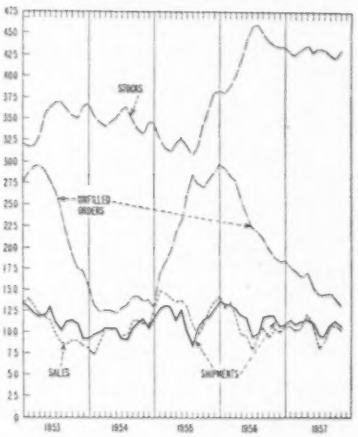
	Oct.	Nov.
Stock, beginning	153,766	155,925
Production	81,492	79,754
Prod., daily rate	2,629	2,658
Shipments:		
U. S. industry	66,225	73,419
Export, drawback	372	581
U. S. Gov't	12,736	9,148
Total	79,333	83,148
Stock, end	155,925	152,531
Unfilled orders	31,466	21,867

Aluminum business in most of the world is slow. Japanese refiners have been much concerned—Japan had been importing metal until last summer. Now they have a surplus and had hoped to export some. They have had little success. The Australian Aluminum Production Commission is concerned about its stocks of metal. It is asking the Government to reduce imports. November output in the U.S. according to the Aluminum Association was 135,024 tons; a year ago it was 145,081 tons. Kaiser has postponed indefinitely starting alumina production at its Gramercy Works owing to the oversupply. It is also closing one of its eight potlines in Washington.

Cadmium dropped to $1.55 per lb for consumers. There had been much undercutting of the $1.70 price to consumers. The producer price charged distributors had not been officially reduced.

Barter on a large scale is not likely to be resumed, according to officials of the U.S. Argiculture Dept. and to brokers that have done this kind of business. The Barter Division last week clarified its rules and modified them slightly. A new list of countries was issued with which barter may be done without proving it would not replace regular sales for dollars. Brokers say there are countries with which no such business would be done—Canada, for instance, is a country to which wheat can be sent. For other countries an official of the foreign country must sign that it will mean "additional" business and one from his U.S. Embassy must indicate that the former is a responsible official.

U. S. Copper Fabricator Data



U.S. Copper Association data, thousands of short tons, through November. Sales, shipments and unfilled orders are for fabricated products and are two months moving averages.

Average Prices Dec. *(E&MJ Quotations)*

Copper:	
Electrolytic, domestic refinery	26.320
Electrolytic, export refinery	22.418
Lead:	
Common, New York ó	13.000
Common, St. Louis	12.800
Silver and sterling exchange:	
Silver, New York, per oz.	89.798
Silver, London, pence per oz.	77.325
Sterling Exchange	280.580
Zinc:	
Prime Western, East St. Louis	10.000
Prime, Western, delivered (g)	10.500
Tin:	
New York Straits	92.440
Gold per oz. U. S. price	$35.000
Quicksilver, per flash	$225.000
Antimony, (E&MJ) (d)	36.590
Antimony, bulk, Laredo	33.000
Antimony, in cases, Laredo	33.500
Platinum, refined, per oz.	$77.600
Cadmium (a)	165.800
Cadmium (b)	165.800
Cadmium (c)	165.800
Aluminum, 99% plus ingot	28.100
Magnesium, ingot	35.250
Nickel (f)	74.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.

(a) Cadmium average based on the producers quotations.

(b) Cadmium average based on the average of the producers' and platers' quotations.

(c) Cadmium average based on platers' quotation.

(d) Domestic, 5 tons or more but less than carload lots, packed in case f.o.b. New York.

(f) Contract price, f.o.b. Port Colborne, U.S. duty included.

(g) Delivered where freight exceeds 0.5c.

"Free" Gold Market

Gold trading declined by 8% in 1957; total sales amounted to $1.515-billion. Bar gold prices fluctuated slightly. Karachi showed 5½% increase; Warsaw a loss of 14%. Coin prices settled to lower levels; Hong Kong rose 8¾% and Warsaw fell 13¾%. Principal events of the year were: relaxation of gold restrictions in West Germany, increased coin minting and large Soviet gold sales in London and Zurich. Pick's World Currency Report quotes on "free gold" per fine oz as follows:

	COINS		BARS (12.5 kg)	
	Nov. 30	Dec. 31	Nov. 30	Dec. 31
NEW YORK, transit	.....	.....	$35 08¾	$35 08¾
MANILA	$44 00	$44 00	36 50	36 60
HONG KONG	45 75	46 25	38 25	38 63
BOMBAY	58 25	58 00	57 50	57 00
TANGIER	42 25	42 50	34 94	34 96
BEIRUT	43 20	43 10	35 10	35 10
PARIS	43.90	43.00	36.45	36.15
BUENOS AIRES	38.50	39.15	36.00	36.30

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Custom Smelter Copper Price

Based on flat price and E&MJ-average price sales in U. S. for month of December reported by American Smelting & Refining Co.: electrolytic copper in standard shapes, adjusted to nearest ⅛c; ¼c deducted for selling commission.

Delivered Consumers' plants . . 25.125c lb
F.o.b. refinery . . . . . 24.725c lb

Major Metals

U. S. DAILY AND AVERAGE PRICES

Dec. 1957	Electrolytic Copper (a) Domestic	(b) Export	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Primary Pig 99%	Straits Tin New York
2	26.025	22.675	13.000	12.800	10.500	10.000	26.000	90.750
3	26.075	22.750	13.000	12.800	10.500	10.000	26.000	90.375
4	26.075	22.800	13.000	12.800	10.500	10.000	26.000	91.500
5	26.100	22.400	13.000	12.800	10.500	10.000	26.000	91.875
6	26.325	22.725	13.000	12.800	10.500	10.000	26.000	93.250
7	No Market	22.725	13.000	12.800	10.500	10.000	26.000	93.250
9	26.500	22.950	13.000	12.800	10.500	10.000	26.000	92.875
10	26.375	23.150	13.000	12.800	10.500	10.000	26.000	92.625
11	26.375	22.425	13.000	12.800	10.500	10.000	26.000	92.750
12	26.100	21.650	13.000	12.800	10.500	10.000	26.000	92.250
13	26.200	21.800	13.000	12.800	10.500	10.000	26.000	92.750
14	No Market	21.800	13.000	12.800	10.500	10.000	26.000	92.750
16	25.650	21.950	13.000	12.800	10.500	10.000	26.000	93.750
17	26.450	22.950	13.000	12.800	10.500	10.000	26.000	93.000
18	26.300	23.100	13.000	12.800	10.500	10.000	26.000	92.750
19	26.550	22.375	13.000	12.800	10.500	10.000	26.000	92.500
20	26.550	22.450	13.000	12.800	10.500	10.000	26.000	92.375
21	No Market	22.450	13.000	12.800	10.500	10.000	26.000	92.375
23	26.500	22.125	13.000	12.800	10.500	10.000	26.000	92.500
24	26.600	21.950	13.000	12.800	10.500	10.000	26.000	92.625
25	Holiday							
26	26.400	22.575	13.000	12.800	10.500	10.000	26.000	92.750
27	26.525	22.100	13.000	12.800	10.500	10.000	26.000	92.625
28	No Market	22.100	13.000	12.800	10.500	10.000	26.000	92.675
30	26.475	22.375	13.000	12.800	10.500	10.000	26.000	92.375
31	26.575	22.100	13.000	12.800	10.500	10.000	26.000	91.750
AVERAGES FOR MONTH								
Dec.	26.320	22.418	13.000	12.800	10.500	10.000	26.000	92.440
AVERAGES FOR WEEK								
Dec.								
4	26.175	22.533	13.200	13.000	10.500	10.000	26.000	91.025
11	26.335	22.729	13.000	12.800	10.500	10.000	26.000	92.770
18	26.140	22.208	13.000	12.800	10.500	10.000	26.000	92.875
25	26.500	22.270	13.000	12.800	10.500	10.000	26.000	92.475
CALENDAR WEEK AVERAGES								
Dec.								
7	22.120	22.679	13.000	12.800	10.500	10.000	26.000	91.833
14	26.110	22.296	13.000	12.800	10.500	10.000	26.000	92.667
21	26.300	22.546	13.000	12.800	10.500	10.000	26.000	92.792
28	26.506	22.170	13.000	12.800	10.500	10.000	26.000	92.625

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Dec. 1957	Silver (c) New York	Silver London	Sterling Exchange	Gold London	Gold (d) United States
2	90.000	77.625d.	280.8125	249s. 3d.	$35.00
3	90.000	77.625d.	280.7812	249s. 1½d.	35.00
4	90.000	77.625d.	280.6250	249s. 1½d.	35.00
5	89.750	77.625d.	280.5625	249s. 4½d.	35.00
6	90.000	77.375d.	280.5000	249s. 4½d.	35.00
7	(e)	(e)	(e)	(e)	35.00
9	90.000	77.375d.	280.6562	249s. 4½d.	35.00
10	90.000	77.375d.	280.5625	249s. 4½d.	35.00
11	90.000	77.375d.	280.2187	249s. 6¼d.	35.00
12	90.000	77.375d.	280.5000	249s. 6½d.	35.00
13	89.875	77.375d.	280.5937	249s. 3½d.	35.00
14	(e)	(e)	(e)	(e)	35.00
16	89.875	77.375d.	280.6562	249s. 3½d.	35.00
17	89.625	77.375d.	280.5625	249s. 4d.	35.00
18	89.625	77.125d.	280.4687	249s. 6d.	35.00
19	89.625	77.125d.	280.5000	249s. 6½d.	35.00
20	89.625	77.125d.	280.5687	249s. 6d.	35.00
21	(e)	(e)	(e)	(e)	35.00
23	89.625	77.125d.	280.4687	249s. 5½d.	35.00
24	89.625	77.125d.	280.3750	249s. 7¼d.	35.00
25	Holiday				
26	89.625	Holiday	280.5000	Holiday	35.00
27	89.625	77.125d.	280.5312	249s. 5¾d.	35.00
28	(e)	(e)	(e)	(e)	35.00
30	89.625	77.125d.	280.7968	249s. 4½d.	35.00
31	89.625	77.125d.	280.9375	249s. 3d.	35.00
AVERAGES FOR MONTH					
Dec.	89.798	77.325d.	280.580	—	35.00
AVERAGES FOR WEEK					
Dec.					
4	90.000	—	280.680	—	35.00
11	89.950	—	280.500	—	35.00
18	89.800	—	280.556	—	35.00
25	89.625	—	280.478	—	35.00

Calendar Week Averages: New York Silver: Dec. 7th, 89.950; 14th, 89.975; 21st, 89.675; 28th, 89.625.
(e) No Market (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.400c per pound, the average differential for delivery charges.

(b) Our export quotations for copper reflect prices obtaining in the open market and are based on sales in the foreign market reduced to the f.o.b. refinery equivalent. Atlantic seaboard. On f.a.s. transactions we deduct 0.125c for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West effective Jan. 1, 1951, commanded a premium of 1.35c per pound over the current market for Prime Western; Special High Grade 1.75c effective Dec. 1, 1955.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 pounds.

(e) The daily silver quotation reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

MARKETS (*Continued*)

London Metal Exchange Quotations

Dec.	COPPER Cash Bid	COPPER Cash Asked	COPPER 3 Mo. Bid	COPPER 3 Mo. Asked	LEAD Current Month Bid	LEAD Current Month Asked	LEAD 3 Mo. Bid	LEAD 3 Mo. Asked	ZINC Current Month Bid	ZINC Current Month Asked	ZINC 3 Mo. Bid	ZINC 3 Mo. Asked	TIN Cash Bid	TIN Cash Asked	TIN 3 Mo. Bid	TIN 3 Mo. Asked
2	183½	183¾	188	188½	78¼	78¾	79	79½	66	66¼	66	66¼	730	730½	709	710
3	182¼	182½	186¾	187	76¼	76¾	76¾	77¼	64½	64¾	64¼	64½	730	730½	705	706
4	185	185½	189½	190	76¼	76½	77¼	77¾	64½	64¾	64½	64¾	730	730½	718	719
5	183	183½	187½	188	75¾	76	77¼	77½	64½	64¾	64¾	65	730	730½	718	718
6	182¾	183	187	187½	73¾	74	75	75½	63¼	63½	63¾	64	733	733½	733	733
9	182	182¼	186	186½	72	72¼	73¼	73½	62½	62¾	62¾	63	730½	731	733	734
10	180	180½	184½	184¾	69¼	69½	71	71¼	61	61¼	61½	61¾	730	730½	730	731
11	176	176½	180¾	181¼	69½	70	71	71½	61¼	61½	61½	61¾	730	730½	730½	731
12	177¾	178	181¾	182	69	69½	70¼	70½	61	61¼	61	61½	730	730½	730½	731
13	179	179½	183½	183¾	70¾	71	71½	71¾	61¾	62	62¼	62½	730	731	735	735½
16	188½	189	193	193½	72¼	72½	72¾	73¼	62½	63	63	63¼	732	732½	740	742½
17	183	183¼	187¾	187½	72½	72¾	73½	73¾	62½	62¾	62½	62¾	730	730½	735	736
18	180½	180¾	185	185¼	72½	72¼	72¾	73	62¾	63	62¾	63	730	730½	732½	733
19	180½	180¾	185	185½	73½	73¾	73½	73¾	63	63¼	63¼	63½	730	730½	730½	731
20	180¾	181	185¼	185½	74	74½	74¼	74½	63½	63½	63½	63¾	730	730½	730½	731½
23	178¼	178¾	183	183¼	74¼	73½	73½	73½	62½	62½	62½	62½	730	730½	731	731½
24	179½	179¾	183½	184	73¼	73½	73¼	73½	62	62½	62	62¼	730	730½	732	732½
25	Holiday															
26	Holiday															
27	180	180¼	183½	184	73¼	73⅝	73¼	73½	61½	61¾	61½	61¾	730	730½	731½	732
30	182	182¼	185½	185¾	73¾	74	73½	73¾	61¾	62	61¾	62	730	730½	730½	731
31	181	181½	184¼	184¾	73	73¼	73¼	73½	61¼	61½	61½	61¾	730½	731	727½	729
Av'g's.	£181.431		£185.719		£73.213		£73.909		£62.794		£62.959		£730.563		£728.563	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.97%, zinc 98¾ and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments f.o.b. New York unless otherwise stated, tons of 2,000 lb. unless otherwise noted. St—short ton; lt—long ton.

MISCELLANEOUS METALS

December 31, 1957

Aluminum ingot, 99 plus % lb.			28.1¢
Antimony, spot, lb. less than carload, in cases			36.50¢
In bulk, carload lots, f.o.b. Laredo			35.00¢
Bismuth, ton lots, lb.			$2.25
Cadmium, commercial sticks, delivered, lb.			$1.55
Calcium, lb. ton lots 98%, cast			$2.05
Chromium, 97% grade, lb. contract del.			$1.29
Cobalt, 97 to 99%, per lb. eff. Feb. 1, 1957			$2.00
Germanium, per gram, 10,000 gram lots	(c)38¢	@ (d)45½¢	
Indium, troy oz.			$2.25
Lithium, lb. 98%	$11.00	@ $14.00	
Nickel, cathodes, lb (a)			74¢
Other sales, reg. sellers			74¢
Sales by dealers, etc.	70¢	@ 75¢	
Magnesium, 99.8% carloads, lb. producer's plants, Velasco, Texas, eff. Apr. 16			35¼¢
Palladium, troy oz.	$21.00	@ $22.50	
Platinum (wholesale lots), troy oz.	$76	@ $80	
Quicksilver, flask of 76 lb., 25 flasks or more	$225	@ $230	
Selenium, 99 plus %, lb—(No., 18, 1957)			$7.50
Silicon, minimum 97%, carloads, lb.			22¢
Semi-Conductor grade, lb.			$350
Tellurium, lb.			$1.65
Thallium, 100 lb. or more, lb.			$7.50
Titanium, 99.3 plus, grade A-1, max. 3% iron, lb.			(b)$2.25

(a) Eff. Dec. 6, 1956; incl. U. S. duty; (b) Effective June 3, 1957.
(c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per short ton unit	$36.00	@	$37.00
Chrome Ore per long ton, f.o.b. cars Atl. ports, dry:			
44% Cr_2O_3 no ratio	$26	@	$26.50
48% Cr_2O_3 3 to 1 ratio	$47	@	$57
Iron Ore, Lake Superior, Lower Lake ports, long ton:			
Old Range bessemer			$11.85(e)
Mesabi bessemer			$11.60(e)
Mesabi, non-bessemer			$11.45(e)
Lead (Galena), 80%, Joplin, Mo., ton			$156.12
Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports, import duty extra, export duty included, $1.36 @ $1.39; both duties excluded, $1.225 @ $1.255. Long-term contract nominal.			
Molybdenum Ore, 90%, per lb. of Mo f.o.b. mines	$1.18	@	$1.23
Columbium-Tantalum, per lb., combined oxides 10 to 1 ratio	$1.15	@	$1.20
Tungsten Ore, per stu of WO_3:			
Foreign 60%, c.i.f. U. S. ports, duty extra	$11	@	$12.50
U. S. scheelite, f.o.b. mill	$18.50	@	$19
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines			31¢
Zinc Ore, Prime, 60% concentrate, Joplin, Mo., per ton			$56

(a) Nominal.
(e) Eff. 1957 shipping season.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb., in bbl. carload lots delivered			5½¢
Cobalt Oxide, 72½% to 73½%, per lb. eff. Dec. 1, '56	$1.52	@	$1.55
Copper Sulphate, 100 lb eff. Sept. 3, '57			$11.55
Germanium Oxide, gram			27½¢
Molybdic trioxide, technical, per lb. of Mo	$1.38	@	$1.41
Imported, incl. 37¢ duty	$1.75	@	$2.05

ALLOYS

Ferrochrom 65 to 70%, per lb. of Cr. (4-9% C)			28¾¢
Ferromanganese, 74 to 76%, per lb., shipg. pt.			12¼¢
Ferromolybdenum, 58 to 64% Mo, lb. of Mo contained	$1.68	@	$1.74
Ferrosilicon, 50% per lb. of Si f.o.b. shipping point (3-19-57)			14.20
Ferrotungsten, 72 to 82%, lb. of W contained			$2.15
Ferrovandium, per lb. of V delivered	$3.20	@	$3.40
Silicomanganese, max. 1½% carbon, lb., contracts			12.8¢
Spiegeleisen, per long ton, 10 @ 21% grade eff. Jan. 7			$102.50

NON-METALLIC MINERALS

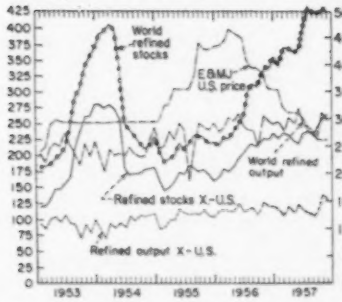
Asbestos, o.b. Canada (Quebec) mines (Canadian funds) ton:			
Crude No. 1	$1,470	@	$1,810
Crude No. 2	$788	@	$1,155
Spinning fibers	$353	@	$593
Shingle fibers	$190	@	$220
Paper stock	$120	@	$142
Waste	$82	@	$86
Shorts	$27	@	$75
Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):			
Crude No. 1			$1,522
Spinning fibers	(b)$494	@	$787
Shingle fibers	$142	@	$325
Asbestos, Vermont, f.o.b. Hyde Park:			
Spinning fibers	$353	@	$383
Shingle stock	$172	@	$190
Paper stock	$114	@	$145
Waste, stucco or plaster			$82
Refuse or Shorts	$39	@	$72
Barytes f.o.b. cars:			
Georgia, crude, per ton			$18
Missouri, 94% $BaSO_4$, per short ton	$16	@	$18
Crude oil well grade, min. 4.3% sp. gravity, st (a)			$18
Imported, c.i.f. Gulf Ports, st	$16	@	$18
Bauxite, long ton, f.o.b. point of shipment:			
Domestic, crude, 50 to 52% (not dried)	(c)$ 5.00	@	$5.50
Domestic, chemical, 55 to 58%	(c)$ 8.00	@	$8.50
Domestic, abrasive, 80 to 84%	(c)$18.00	@	$18.50
Imported metallurgical, per lt, f.o.b. Br. Guiana, dep. on grade			$7.14
Feldspar, bulk ton:			
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50	@	$22.50
Glass feldspar, white, 20 mesh	$10	@	$12.50
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37	@	$41
60% effective CaF_2	$33	@	$36.50
Acid 97% concentrate, bulk, ton (eff. 12-1-56)			$50.00
Some sellers quote			$55
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00	@	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington			$46
Mica—Domestic, f.o.b. mines. Punch 7¢ to 12¢ per lb. according to size and quality. Sheet clear, 1½ x 2-inch, 70¢ to $1.10; 2 x 2-inch, $1.10 to $1.60; 2 x 3-inch, $1.60 @ $2.10; 3 x 3-inch, $1.80 @ $2.30; 3 x 4-inch, $2.00 @ $2.60; 3 x 5-inch, $2.60 @ $3.00; 4 x 6-inch, $2.75 @ $4.00; 6 x 8-inch, $4.00 @ $8.00. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground: $32.50 @ $70.00 per ton. Scrap, $25 and up.			
Ocher, Georgia, ton, in sacks	$26.50	@	$32.00
Pyrites, Spanish, per long ton unit of S. c.i.f. atlantic ports			Not quoted
Sulphur, per lt, f.o.b. U. S. mines: bright			$23.50
dark	$22.50	@	$23
Mexican, for use in Mexico, per metric ton, f.o.b. mines, 280 to 395 pesos, depending on use	$22.40	@	$31.60
For export f.o.b. vessel, lt, dep. on grade	$22	@	$24
Talc, f.o.b. works, ton:			
New York, purified	$18.00	@	$20.00
Vermont, extra fine			$12.50
Tripoli, Missouri, ton:			
40-mesh, cream colored			$50.00

(a) Some restricted sales at $11.50. (b) Corrected. (c) Nominal.

IRON AND STEEL

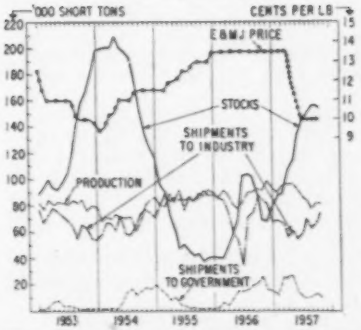
Pig Iron, gross ton, basic, Valley Furnaces			$66.00
Steel, f.o.b. Pittsburgh, billets, net ton			$77.50
Structural shapes, Pa., Ala., etc, 100 lb.	$5.10	@	$5.275

Copper Production and Stocks



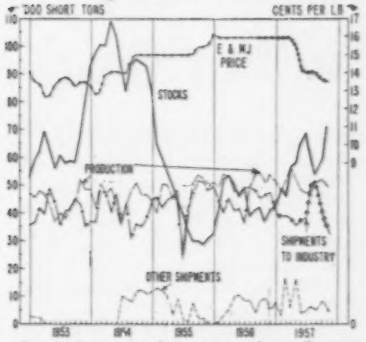
Data are from the Copper Institute and are in thousands of short tons. They include November 1957. World Refined output and stocks do not include the U.S.S.R., Japan, the Scandinavian countries, Australia, Yugoslavia, and the Mesina Mine in Transvaal. The two series "X-U.S." are the above world producer statistics less the U.S. No fabricator stocks are included.

U. S. Slab Zinc



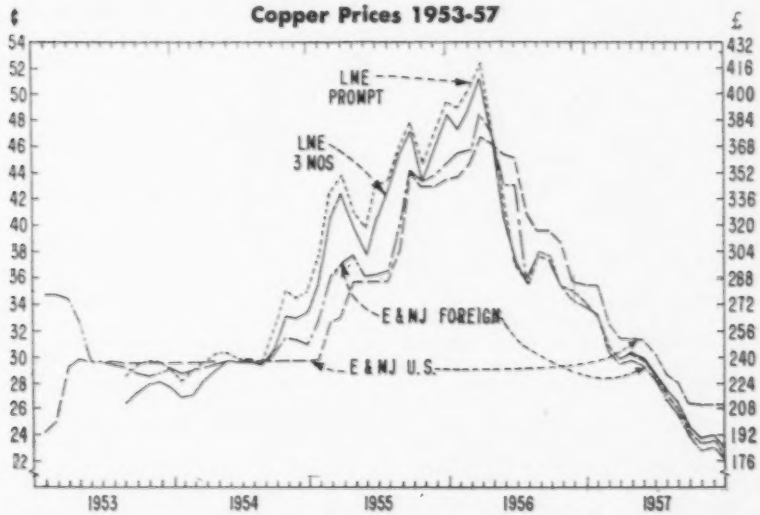
The above data, except price, are from the American Zinc Institute and are in thousands of short tons. They refer to slab zinc of all regularly operating U.S. primary and secondary smelters. Production from foreign ores is included. The price is the E&MJ East St. Louis monthly average. Data include November 1957.

Primary Refined Lead Data



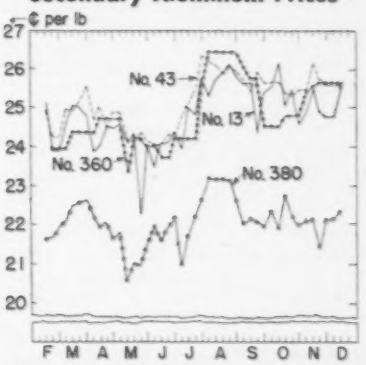
Above data are from American Bureau of Metal statistics. They refer to total refined lead as reported by all U.S. primary refiners. Some secondary lead is included. "Other shipments" are assumed to be lead to U.S. Government. The price is the E&MJ monthly average N. Y. price. Data include November 1957.

Copper Prices 1953-57



Monthly averages. *E&MJ* weighted averages are computed from actual reports of sales to *E&MJ*—normally 140,000 to 175,000 tons per month. LME prices are the average of the mean of the bid and asked and they refer to long tons. The two scales are equal at an exchange rate of $2.80 per £. £320 is 40c a lb, etc. Data through December 1957.

Secondary Aluminum Prices



The prices charted above are the weekly weighted average prices calculated by *E&MJ Metal & Mineral Markets* from data supplied each week by major U.S. secondary aluminum producers. Each firm reports quantity of sales and prices at which sales were made. Latest date in chart is Dec. 11.

Metal Statistics Signal Market Switches

The above charts are published regularly in the weekly issues of *Metal & Mineral Markets* to show the status of the copper, lead and zinc industries at a glance. Persistent accumulation of stocks in the hands of producers indicates overproduction, and as these stocks soar, prices have a tendency to drop. In the charts for lead and zinc, the accumulation of stocks by producers has been obscured somewhat by shipments to Government stockpile which are indicated by the dotted lines at the bottoms of the charts. Had these monthly shipments been added to the accumulated producers' stocks, the high surplus production of metal would have been more apparent.

The current overproduction of copper would be much more obvious if shipments to the U.S. Government, which were about 83,000 short tons in 1957, were added to the world stock figure shown in the chart.

These charts will continue to appear in the issues of *E&MJ* to enable the readers to determine changing conditions in the metal markets and, perhaps, to enable the reader to discern improvements in the markets in advance.

The relationships between the *E&MJ* foreign copper price, the London Metal Exchange quotations, and the *E&MJ* domestic copper price are also significant. Note how the *E&MJ* foreign price and the LME quotations lead on both the rising and falling markets. It will be interesting to note whether this relationship will signal stronger copper markets in the future.

At the request of major secondary aluminum producers, *E&MJ Metal & Mineral Markets* publishes weekly prices of important alloys used chiefly in die-casting. Weighted averages are based upon tonnages and prices reported each week by major producers. On a long-term basis swings in secondary metal prices can indicate significant shifts in the demand-supply situation.

THIS MONTH IN MINING

Indian Iron Mine Scheduled for 1959

Construction is to start immediately on a new iron mine at Barsua, Orissa Province, India, 225 miles southwest of Calcutta. Announcement of the project, which is on top of a 2,600-ft peak, came from Hewitt-Robins Inc., Stamford, Conn., which said it had received a $5.5-million order for material handling at the site.

The new mine, owned by Hindustan Steel Private Ltd., is located in a dense bamboo jungle inhabited by wild elephants. The deposit covers an area about 35 miles long and a mile wide containing an estimated 150-million tons of ore. The iron content ranges from 54 to 65%, roughly comparable to the ore mined on the famous Mesabi range in Minnesota.

Project will be headed by E. H. Fallon, contract engineer in the Hewitt-Robins New York engineering department. A resident engineer, W. J. Matus, and his staff, will be stationed at the mine site.

Here is how the material handling system will work:

Ore weighing 150 lb per cubic foot will be excavated by electric power shovels and trucked to a crushing station which will be built near the mountain peak at an altitude of 2,600 ft. Crushers will reduce all oversize lumps to 3¼-in. in diameter in preparation for transfer to the conveyors which will carry the ore down the mountain to a screening station located at an altitude of 1,300 ft.

Five conveyors totaling 9,500 ft in length will be linked together in a continuous system to carry the ore at a rate of 700 long tons per hour from the crushing station down to the screening station. The conveyors will actually drive the motors once the load starts moving, causing the motors to act as generators. Operating in this fashion, the motors will generate approximately 800 hp of electricity that will be fed to the crushers and other equipment. A unique drive and braking mechanism developed by Hewitt-Robins engineers will be used to control the descent of the conveyors so that they will run evenly at all times and will not run away under their heavy load.

At the screening station, all ore will be classified so that lump size will range from ¼ in. to 3¼ in. All ore under ½ in. will be diverted to a storage pile, to be held indefinitely until a future sintering plant is built which will agglomerate the fines into lumps large enough to be suitable for blast furnace feed. The ore to be shipped will be loaded aboard rail cars which will arrive and depart in 20-car trains, hauling approximately 6,000 long tons daily to the steel mill at Rourkela.

In addition to the 9500-ft conveyor system on the mountain side, the project will involve additional conveyor units required to move the ore at the crushing and screening stations, and the railroad loading facility. All conveyors will have a combined length of 12,150 feet.

The new iron mine at Barsua and the new million-ton-a-year steel plant at Rourkela are the latest steps in India's five-year plan aimed at improving the industrial production and living standards of the nation. Under this plan, steel production will be expanded to 6-million tons of ingots a year by 1961, and major expansion will also take place in hydro-electric power and transport fields.

Construction Is Due at Wyoming Uranium Mill

CONSTRUCTION was expected to start on Fremont Minerals Inc.'s new 500 tpd uranium mill at Riverton, Wyo., shortly after the first of the year, Allen D. Gray, executive vice president, said.

The mill is expected to cost $3.5-million, but this figure does not cover other cost factors such as working capital and purchase of uranium ore at the AEC stockpile in Riverton.

Gray said Fremont would resume operations of the ore buying station at Riverton Feb. 1. However, he said ore purchases would be on a limited basis until the mill gets into operation, expected in about a year.

Fremont Minerals' mill will have two separate leaching circuits—one an acid leaching circuit for low-lime ores and a carbonate leaching circuit for the high-lime ores found in the Douglas and Pryor Mountain areas.

Gray explained that the two circuits will be combined in the final stages of processing where uranium will be recovered through solvent extraction. He said it was expected the plant would process more low-lime ore from the Gas Hills and Crooks Gap area than high-lime ore from other parts of Wyoming.

The uranium ore stockpile at the AEC buying station is expected to provide enough feed for the mill for the first year's operation. No ore shipments have been received at Riverton since last Jan. 1.

Gray said the company has been at work for the past two months on design work, flowsheet and preliminary engineering for the mill. He said field construction is expected to begin after the first of the year as soon as the complete design work is finished.

Preliminary engineering has been done by Western-Knapp Engineering Co., San Francisco, and the metallurgical design has been done by H. L. Hazen, Inc., Denver.

Gray explained that Fremont Minerals would handle negotiations with a general contractor for construction of the plant.

Fremont will maintain its administrative headquarters in Denver, but will have a sub-office in Riverton. Fremont Minerals is a subsidiary of Susquehanna Corp. of Chicago, which is also the parent company of Mines Development Inc., operator of a uranium processing mill at Edgemont, S. D.

Gray said virtually all of Fremont's capacity would be reserved for independent producers.

As soon as the uranium mill begins operation, the ore buying station at Riverton will be closed and Fremont will take over the stockpiled ore. The Fremont plant will be located near the AEC buying station.

Fremont, which has had application for a concentrator at Riverton before AEC since late 1956, was cut from original proposal of 750 tpd to 500 tpd, in final contract negotiations.

At that, the fact that the firm has no proved uranium reserve of its own, has been subject to some criticism by other owners of big ore reserves in the district who are involved in pending applications for concentrates sales contracts (mills) before the Government agency.

Some five other mill proposals still pend before the AEC's Grand Junction (Colo.) Operations Office. They seek a total ore input capacity of 4,300 tpd.

Existing or approved mill capacity for the district—one of the largest in the United States from uranium ore reserve standpoint—totals 1,150 tpd.

By grant of the Susquehanna proposal, however, AEC has taken needed first step in unraveling the "race" for mill contracts in the area.

It is perhaps significant that Fremont was given the stockpile of ore, estimated by some in the 70,000 to 150,000 ton range, to run through its mills.

Previously, AEC had an option which would have required Lucky Mc Uranium Co. to run this stockpile. That option had been extended during the course of the Fremont Minerals negotiations. It expired Dec. 31.

This means that Lucky Mc, controlled by Utah Construction Co., worldwide mining and contracting firm, will have an additional space in its 750 tpd concentrator for other ores. The firm, joined by Phelps Dodge Corp., has proposed expansion by 1,000 tpd to 1,750 tpd. of its concentrator.

Other firms which have mill proposals before AEC, including Lucky Mc,

are Western Nuclear Corp., which seeks expansion of existing 400 tpd mill by 800 tons to 1,200 tpd; Globe Mining Co. (with Union Carbide Nuclear), a 1,000 tpd mill; Vitro Minerals Corp. with Atlas Corp., a 1,000 tpd mill; Federal Uranium Corp., Salt Lake City, a 500 tpd mill.

Mr. Gray said that Fremont already had "four important independent producers of uranium ore in the district signed for contracts."

W. S. Moore Co. Studies N. Y. Magnetite Deposit

W. S. Moore Co. of Duluth, Minn., currently operating on the Mesabi Range in Minnesota, has two drills exploring several magnetite orebodies in the vicinity of Newton Falls, New York. The nature of the ore is very similar to Jones & Laughlin's Benson Mines. Results so far are quite satisfactory. Core is being tested at Erie Laboratory at Hibbing, Minn. If sufficient open pit reserves can be proven, a concentrating plant to produce 300,000 to 400,000 tons of high grade pellets annually will be built.

Robert Simon, mining engineer for the W. S. Moore Co. is in charge of the drilling. The major deposits are owned by the Newton Falls Paper Mill, Inc. One of the properties, the Parish anomaly, is owned by International Talc Co. of New York. If and when developed, the mines will be operated on a year round basis. From 4-million to 6-million tons of concentrates produced by open pit operations will be required to justify construction of a magnetic separation plant to treat the ore, according to W. S. Moore Co. officials.

Mining Calendar

Governor's Industrial Safety Conference (California). Eighth annual meeting. San Francisco, Feb. 6-7

National Western Mining Conference, Feb. 6-8, Denver, Colo.

AIME, annual meeting. Hotel Statler and Sheraton-McAlpine, New York. Feb. 16-20

1958 Nuclear Congress, International Amphitheatre, Chicago, Illinois, March 17-21

Pacific Southwest Conference, AIME, St. Francis Hotel, San Francisco, March 17-29

American Chemical Society, 133rd National Meeting, San Francisco, April

13th Purdue Industrial Waste Conference Purdue University, LaFayette, Indiana, May 5-8

13th Annual Instrument-Automation Conference & Exhibit, Convention Hall, Philadelphia, September 15-19

5th World Petroleum Congress, Coliseum, New York City, June, 1959

(Continued on page 144)

As We Went to Press . . .

Less than two years after original site-clearing, the first ingot was poured at Canadian-British Aluminium Co. Ltd.'s works at Baie Comeau, Quebec.

Present capacity of 45,000 short tons of ingots per year is expected to be doubled by the spring of 1959 and brought to a total of 180,000 tons if future plans are followed.

Society of Mining Engineers, AIME, will conduct 36 technical sessions at the national convention, to be held Feb. 16-20 in New York. Elmer A. Jones, division manager of St. Joseph Lead Co. at Bonne Terre, Mo., and first president of the society, will make his report at the annual meeting and turn his office over to Stanley D. Michaelson, chief engineer, western mining division, Kennecott Copper Corp.

British Columbia's largest copper mine will keep operating through the winter as a result of an unprecedented move in late December by government, labor, and management working together to keep 400 of the 800 miners at Britannia Mine on Howe Sound. A joint federal-provincial subsidy of $20,000 per month will be supplied for the next six months.

The government agreed to partipicate ($16,000 worth) because a demand is shortly expected from Western Copper Mills copper products plant at Annacis Island, and if the Britannia were closed, "it is a question whether they would ever open again because of the water problem at the mine." Government will also salvage more than $10,000 in income taxes paid by the miners and an estimated $40,000 per month in unemployment insurance it would have to spend if the miners were idle.

Quebec Cartier Mining Co., a U.S. Steel subsidiary, need not offer its planned railway from Shelter Bay, on the St. Lawrence, to Mt. Wright as a common carrier, according to a ruling by the Quebec Legislative Assembly. A bill incorporating the railway company which will construct the 265-mile line must now go to other government branches before passage is assured.

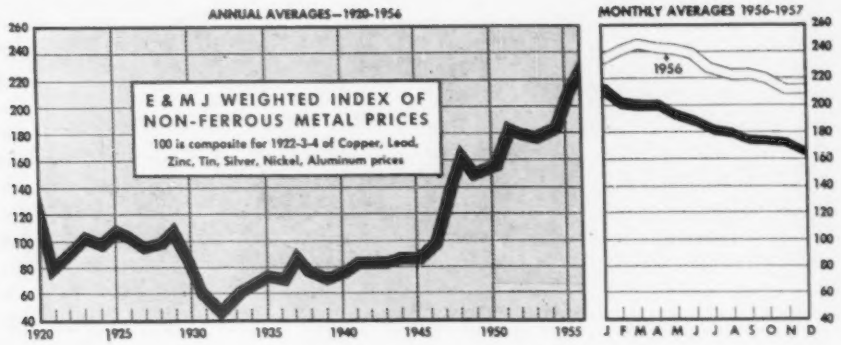
Permission to construct the line as a private carrier was opposed by John C. Doyle, president of Canadian Javelin, Ltd., who told the Public Bills Committee that other companies in the area would have trouble financing their projects if they did not have assurance that the Cartier railroad would be required to carry others' traffic as well as its own. Premier Maurice Duplessis said he did not consider it just to make a new railroad a common carrier.

Lloyd J. Serverson, president of Cartier, told the committee his company was willing to handle the traffic of other concerns under certain conditions.

Vitro Uranium Co. confirms that they have reduced low-grade ore purchases. Contract renegotiated with AEC makes it uneconomic for Vitro to accept ore under 0.2% U_3O_8, says R. C. Cole, vice president. Vanadium Corp. of America and Golden Cycle report ore shipments reduced. Many small independent Marysvale miners will be affected by the decision. See article on p 132.

E&MJ OUTLOOK

PRICES



MARKETS

Lower lead and silver prices dropped *E&MJ's* metal price from 175.46 for November, to 174.30 at the year end. Copper was virtually unchanged, and tin moved up.

●

AT HOME

Late December brought in a surge of year-end outlook reports. Here are some significant ones for the mining industry:

National Electrical Manufacturers' Association predicts that electrical manufacturers will turn out more than $21-billion worth of products in 1958. The 1956 total was $20.57-billion, and the total for 1957, $20.88 billion.

Defense Department officials say that defense orders should increase almost 50% to about $23-billion for 1958.

Automobile manufacturers are trimming down 1958 car output estimates from the previous 6-million-car level indicated some months ago. Harlow H. Curtice, president of General Motors, looks for the 1958 retail car sales to be somewhat lower than the 5.8-million sales for 1957.

Associated General Contractors of America predict that 1958 will be a record $68-billion construction year. This will exceed the 1957 total by $2.8-billion.

Roger M. Blough, chairman, U.S. Steel Corp., expects inventory cutting to keep steel output during the first half of 1958 below the record pace set for 1957. Following inventory liquidation, he says "there is reason to expect a pickup in steel output."

U.S. Atomic Energy Commission reports that the development of thermonuclear power is still remote and that it will therefore not "interfere with the necessary development of reactors for the production of electrical energy from the fission of heavy elements."

●

LABOR

For 1958, the International Union of Mine Mill and Smelter Workers expects trouble increasing membership and providing jobs for members. The fight against foreign imports of lead and zinc will continue.

●

ABROAD

The Government of India plans to set up a $2.1-million plant for the manufacture of a new kind of nickel-free stainless steel.

A joint Canadian and U.S. commission is studying the feasibility of developing power from the tides of Passamaquoddy Bay between New Brunswick and Maine.

Industrias Quimicas Basicas de Mexico will soon start a $6.5-million plant to produce 8,000 tons of titanium dioxide per year in the state of Veracruz. Ultimate capacity will be 12,000 tons per year. Glidden Co. is designing the plant and will provide technical assistance for the project.

A new O-B Cable Fault Locator!

(in a light-weight, rugged, "pocket-size" package)

Here's the simplest, lightest, most inexpensive, and easiest to use cable fault locator ever offered for mine service!

Designed to pinpoint both short and open circuits in trailing cables having two or more conductors — powerful enough to test cables up to 600 feet long! Complete "pocket-size" package consists of four small, extremely rugged elements which are shipped from the factory — and carried around the mine — in the handy canvas bag shown above.

To operate, simply connect battery and signal generator (about the size of a flashlight) to power end of cable and then move along cable with receiver and headphones as shown above.

Headphones and rugged, all-transistor receiver are only parts carried along cable!

Weighs under four pounds, costs less than any cable you'll use it on!

Write for more information now on the O-B Cable Fault Locator, Cat. No. 22567.

4811-M

Ohio Brass

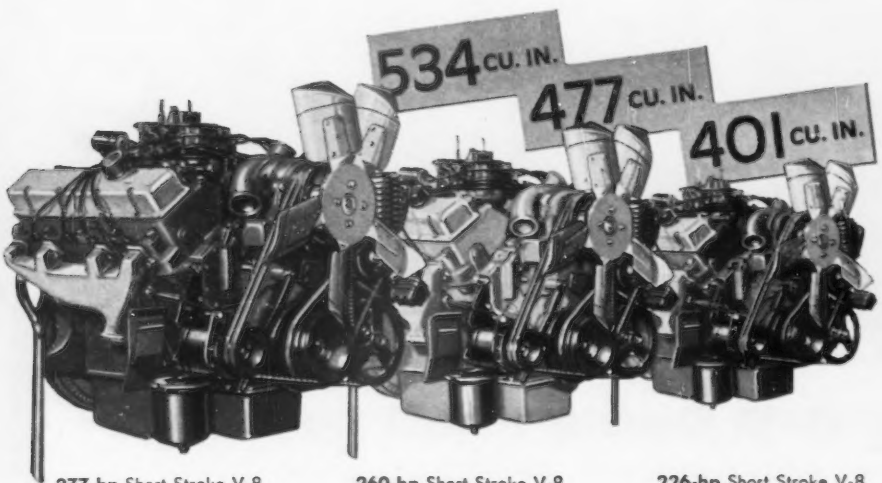
MANSFIELD OHIO, U. S. A.

IN CANADA: CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

FORD makes the

3 all-new Super Duty V-8's

- Gross horsepower up to 277
- Gross torque up to 490 lbs-ft
- Modern Short Stroke design
- Three-stage cooling system
- Machined combustion chambers
- Sodium-cooled exhaust valves
- Stress-relieved block and heads
- Pyramid-type connecting rods
- Internally mounted oil cooler
- Two-quart oil filter
- Water-jacketed intake manifold
- Submerged-type electric fuel pump



277-hp Short Stroke V-8
Torque: 490 lbs-ft
@ 1800-2300 rpm

260-hp Short Stroke V-8
Torque: 430 lbs-ft
@ 1800-2300 rpm

226-hp Short Stroke V-8
Torque: 350 lbs-ft
@ 1800-2300 rpm

10 all-new Extra Heavy Duty Series

GVW's up to 51,000 lb. For '58, ten new basic series are added to Ford's already extensive Heavy and Extra Heavy Duty line. Four new Tilt Cabs, four new Conventionals, and two new Tandem models offer GVW ratings up to 51,000 lb.

GCW's up to 75,000 lb. New T-950 Tandem is rated for 75,000-lb. GCW. Biggest single-rear-axle models are rated for 65,000-lb. GCW.

Front axle capacities up to 15,000 lb. Choice of three front axles in most new Ford Extra Heavies. Rated capacities of 9,000 lb., 11,000 lb. and 15,000 lb.

Rear axle capacities up to 29,000 lb. Wide choice of rear axles includes single-speed and two-speed, single reduction and double reduction types. Capacities range from 18,000 lb. to 29,000 lb.

Bogie axle capacities up to 38,000 lb. For '58 there are two new Extra Heavy Duty Tandem Axle models. The new T-950 Series features a tandem rear axle assembly rated for 38,000 lb. New T-850 Series offers choice of 28,000- or 34,000-lb. bogies.

New highway transmissions. Roadranger transmission is available in all ten new Ford Heavies and Extra Heavies. Up to 33% less shifting. "Short Fourth" highway transmissions also available on "F" and "C" Series. With these new transmissions, engines operate in peak horsepower range with greater fuel economy.

big move for '58

–up to 534 cu. in.

New Series T-950 Tandem model is biggest capacity Ford truck ever built! Rated up to 51,000-lb. GVW—75,000-lb. GCW. New 534-cu. in. Super Duty V-8 provides exceptional horsepower and torque with rugged durability.

FORD TRUCKS COST LESS

LESS TO OWN . . . LESS TO RUN . . . LAST LONGER, TOO!

NOW a Cone-Type Rock Bit is included in the HAWTHORNE "*Blue Demon*" LINE!

a COMPLETE LINE of bits for all soft-medium-hard formation drilling

A Cone-Type Rock Bit . . . for Oil and Minerals Exploration and Quarry Blast Hole Drilling . . . is now included in the Hawthorne "Blue Demon" *All-Formation* drill bit line.

Designed for drilling harder formations than are regularly recommended with the patented "Blue Demon" Replaceable Blade Bits, the Cone-Type Rock Bit is available from authorized Hawthorne dealers in 3⅞", 4¼", 4½", 4¾" and 5⅝" sizes.

Consistently priced, wherever you go, ask for Hawthorne Bits for all your drilling requirements.

WRITE FOR ILLUSTRATED CATALOG

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P. O. Box 7366 • Houston 8, Texas • Cable Address: HAWBIT

EIMCO 630 . . . The Proved, High-Capacity Crawler-Loader

The Eimco 630 Crawler-Excavator is a proven, high capacity, heavy-duty mucking machine. No other excavator has been used as profitably in so many different mining systems.

Working in narrow drifts; wide haulageways; room and pillar stoping; development; drawpoints; under shrinkage stopes; incline loading and in vertical shafts . . . the 630's dependable loading speed and low cost operation is saving money for miners and contractors.

Hundreds of 630 Eimcos, powered by air or electric motors, are handling tough materials the world over for mining and other industries. It is the standard in medium-sized, heavy-duty crawler loaders.

The Eimco 630 utilizes many attachments. Equipped with bulldozer blade, it is ideal for underground operations. It works in spots where scrapers cannot be rigged. Other attachments include fork lifts, front-end loaders, jumbo mounts, timber setters and roof bolters. Attachments can be mounted at the factory or in the field.

When you want loaders, call on EIMCO . . . specialists in loading equipment.

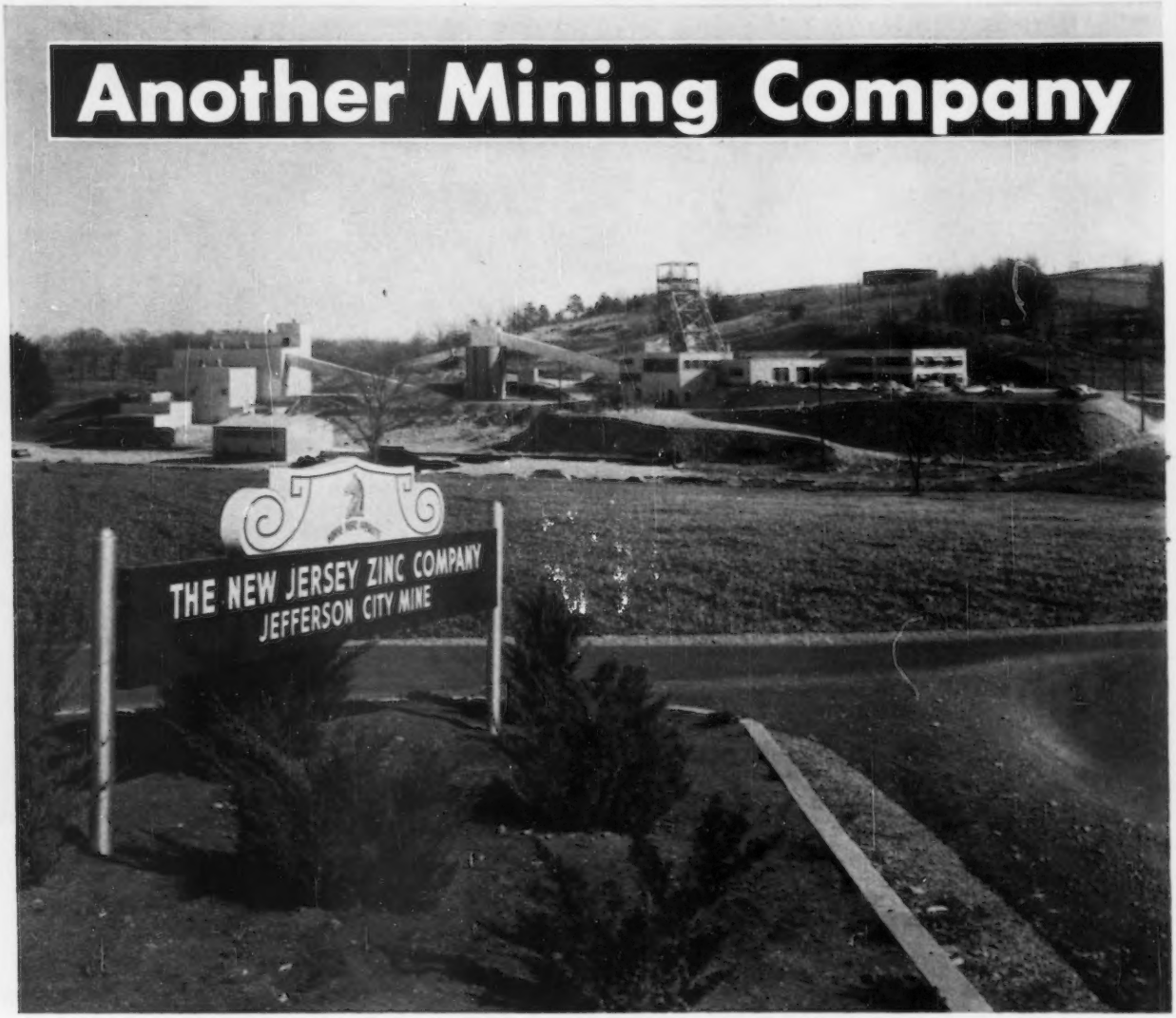
THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Pittsburgh, Pa. Seattle, Wash.
Cleveland, Ohio Houston, Tex. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

B-293

Another Mining Company



This is a new important mining operation that is taking advantage of the cost saving benefits made possible by the Gismo Self-Loading Transport. The Jefferson City Mine of The New Jersey Zinc Company is an example of the result that can be obtained by careful planning, design and selection of equipment.

This Gismo machine makes it possible for you to devise and organize a simple mining method. We believe the lowest cost possible is obtained when your plan provides for the fewest pieces of equipment, supplies and men. The Gismo is simple, versatile — mucks in development or production, can drill as a jumbo, make its own roadways, etc. It can transfer its load direct to cars by means of ramp cars . . . or direct to cars or trucks by means of ramping-over (see circled photo at right) . . . or direct to surge pocket for transfer to a common haulage system or method.

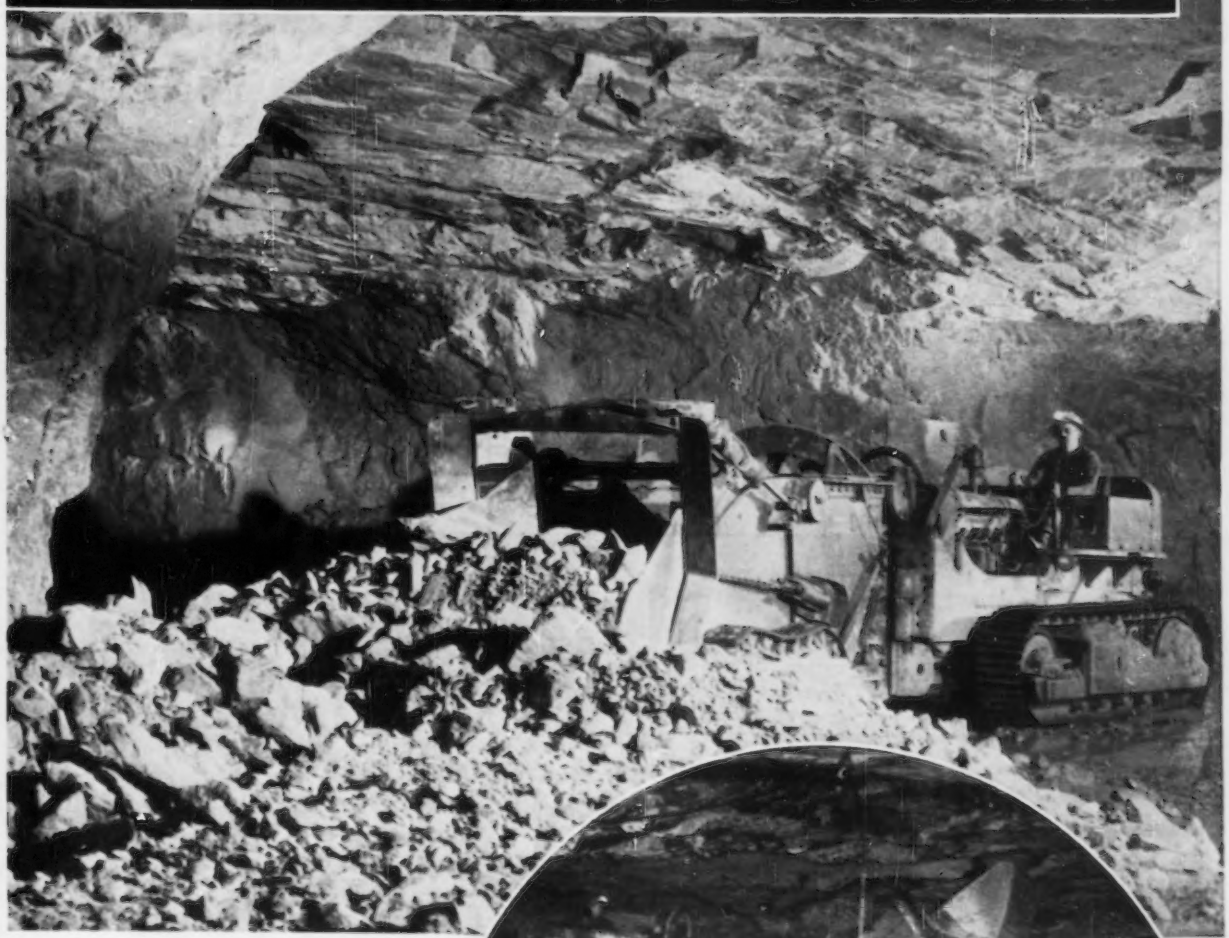
Investigate the extraordinary economies that have been obtained with the use of this remarkable machine. Its principle provides you with a new fundamental opportunity to devise ways and means of cutting costs that you have not had for many years. Write us today. Sanford-Day Iron Works, Inc., Knoxville, Tenn.

SANFORD-DAY

KNOXVILLE, TENNESSEE

SUPER MARKET FOR MINE CARS — all types . . . PRECISION WHEELS . . . BROWNIE HOISTS . . . GISMO SELF-LOADING TRANSPORT that loads in development or production . . . transports . . . supports 2 to 5 jib mounted drills . . . back fills . . . moves boulder rocks . . . makes its own roadways and cleans up completely — a new method of hard rock mining offering a tremendous reduction in cost per ton!

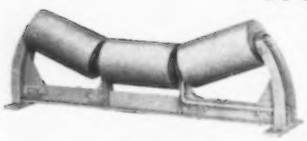
Puts the Gismo® to Work!



THE NEW JERSEY ZINC COMPANY'S Jefferson City Mine incorporates the latest and most modern equipment, including the Gismo, S-D Ore Cars and S-D "Brownie" Hoist. Above you see the Gismo mucking out a load. Circled photo at right shows the ramp-over-cars' transfer point. One man, the Gismo operator, handles the entire operation by means of push-button control of the S-D "Brownie" Hoist. Operator's control lever is located just below roof above the ramp. The S-D "Brownie" Hoist automatically moves trip when another empty car is positioned under ramp. Operating arm located beside cars "tells" hoist when to stop the trip. The S-D Ore Cars haul production to ore pass.

MATCH IDLERS TO THE JOB

...LINK-BELT can meet your specific load and capacity requirements

IDLER SERIES	TYPE OF IDLER DUTY	TYPICAL APPLICATIONS
NEW 50	General duty conveyor • for maximum loads of 100 lbs. per cubic foot • for moderate lump sizes	Designed for conveyors carrying medium loads or for installations requiring intermittent operation.
100 	"Round-the-clock work horse" • handles all but the heaviest and coarsest materials	Coal, coke, sand, gravel, iron ores, sinter, taconite, potash.
200	Rugged heavyweight • for continuous service • carries the heaviest and coarsest materials	Heavy ores, such as iron, copper, etc. . . . on conveyors employing high-capacity belts.

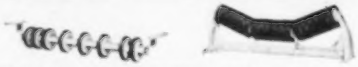
LINK-BELT SERIES 100 IDLERS on this 42-in. wide, 218-ft. long belt conveyor carry 800 tph of ore from primary screens to stock pile.

TO TRAIN YOUR BELTS for proper operation . . .

BELT TRAINING IDLERS Left, positive action type trains and protects single direction belts. Actuating disc type at right is best for reversible conveyors. Self-aligning idlers of both types are also available for return run.

RETURN BELT IDLERS support the empty belt on the return run.

TO PROTECT THEM IN SERVICE



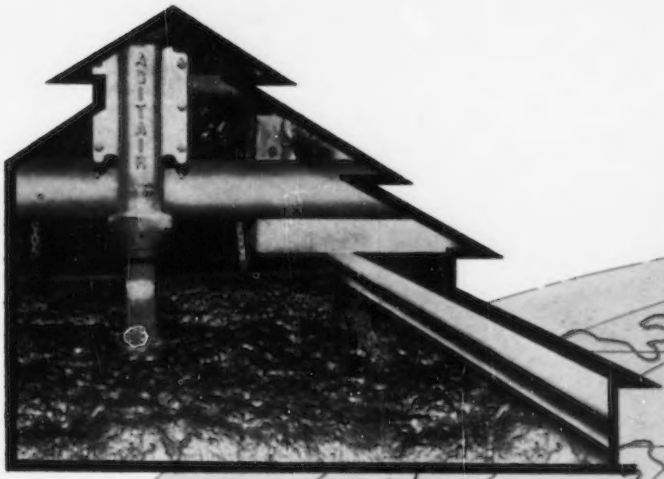
TROUGHED RUBBER CUSHION IDLERS (right) absorb impact under loading points, when large lumps and heavy materials are loaded on belt. Rubber tread return idlers, at left, simplify handling of tenacious materials.

WHETHER you handle cottonseed or coal—Link-Belt makes the exact size and type of belt conveyor idler you need. For top performance . . . lowest per-ton handling cost—see your nearby Link-Belt office or authorized stock-carrying distributor. Ask for Data Book 2416.

LINK-BELT

BELT CONVEYOR IDLERS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville (Sydney), N.S.W.; South Africa, Springs. Representatives Throughout the World. 14



AGITAIR®

is there . . .

Contributing to the wealth of the western hemisphere

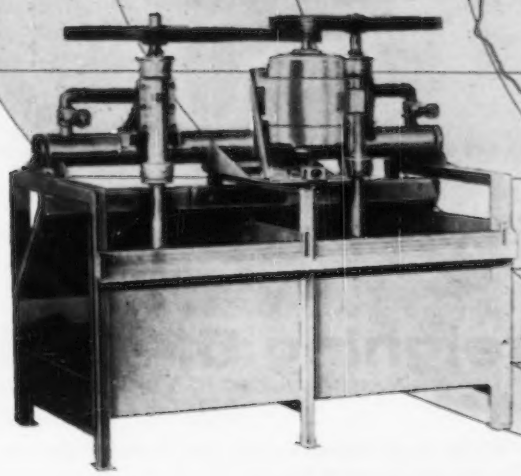
Producing 2000 tons of copper per day

Three large porphyry copper mills in the United States and three in South America will soon be adding over 2000 tons of copper per day to the wealth of the western hemisphere. Some of these mills are well established producers, some are new mills and others are expanding operations . . . all will be in full production in the near future.

In all six of these mills AGITAIR® was chosen for operation in both rougher and cleaner circuits . . . selected by men who know from experience that AGITAIR® adapts best to all the requirements of selectivity and recovery.

Unparalleled performance in flotation, complete air control, low power consumption and simplicity of maintenance are the features that keep AGITAIR® out in the lead!

Correspondence invited. Details gladly supplied to small or large operations in any ore beneficiation industry.



Leaders in Experience and Service

A-515

THE GALIGHER CO.

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GALIGHER PRODUCTS: AGITAIR® Flotation Machine, VACSEAL Pump, Geary-Jennings Sampler, Acid-proof Sump Pump, Geary Reagent Feeder, Laboratory AGITAIR® Flotation Machine, Laboratory Pressure Filter, Laboratory Ball Mill, Rubber Lined and Covered Products, Plastic Fabrication.

High altitudes, narrow benches severely test this Michigan, yet every day it loads

400 tons of rock weighing 5,400 lbs per cubic yard

Up in the scenic Sapphire Mountains of southwestern Montana, Cummings-Roberts Company has one of the toughest rock-loading jobs you could find anywhere.

Part of the time, they blast and load coarse mountain-top granite . . . summer and early fall, they load fluorspar. No one needs to detail what a severe test the heavy, rough granite overburden gives to *any* loader. Fluorspar, however, is even worse. A heavy rock mineral, it weighs 5,400 pounds per cubic yard—over 850 lbs more per yard than in-bank granite (and 2,200 lbs more than pit-run gravel).

Proved by demonstration

Over the years, Cummings-Roberts has tried just about every kind of loader made. Last year to increase efficiency, their Michigan distributor, Miller Machinery Co., Missoula, suggested a Model 175A Michigan Tractor Shovel. "Frankly," Cummings-Roberts officials told them, "we don't believe *any* rubber-tire unit can load the stuff, much less do the work day in and day out. But we'll give it a try."

Result? John Taber, General Superintendent, wouldn't let them take the Michigan off the job.

Heaped loading assures proper blending

Today, the 133 hp 2¾ yard Michigan handles *all* loading of the super-heavy fluorspar. Production, with trucks on 600 ft one-way hauls to crushing mill, averages 400 tons per 7-hour day. The fluorspar, incidentally, varies considerably in grade from place to place through-

out the mine. It must be blended to give the grade desired for shipment . . . and this assignment goes to the Michigan, too. Its 27 mph mobility is a vital asset on this scattered loading; trucks never wait more than a few minutes for loading service.

Strips granite overburden — 500 tons per day!

In late autumn and sometimes in spring, the Michigan strips the granite overburden. Output averages *500 tons* per 7-hour day.

Downtime negligible

With all this rugged loading of super-heavy material, plus repeated back-and-forth maneuvering on narrow benches, plus continuous work at high 6,800 to 7,000 ft altitudes, the torque converter equipped Michigan has posted an excellent mechanical record. *To date, it has had only one minor breakdown!*

Also tows compressors, speeds other odd jobs

Operator Don Lindblom likes Michigan's powershift transmission, says its bucket action is the best he's ever worked with. "You can tip it back and fill it easily," he says. "I like the fact also that it takes only half-an-hour per day to refuel and lubricate." Foreman Waino Lindblom adds, "The Michigan has done a nice job for us! We particularly like its truck-like speed in moving from bench to bench." This mobility gives the Michigan some "spare time" to handle maintenance jobs scattered along 15 mi of mountain roads—cleaning rock rubble off benches so trucks and wagon drills can get through . . . hauling air compressors . . . digging culverts . . . even plowing snow.

Got a tougher job than this?

There *may* be a tougher materials-handling job than loading granite and fluorspar . . . but we're willing to bet a Michigan Tractor Shovel can do it faster, better, at lower cost than any other machine. To prove it, your Michigan Distributor will be glad to arrange a demonstration at *your* convenience. *You pick the jobs.*

CLARK® EQUIPMENT

Michigan is a registered trade-mark of
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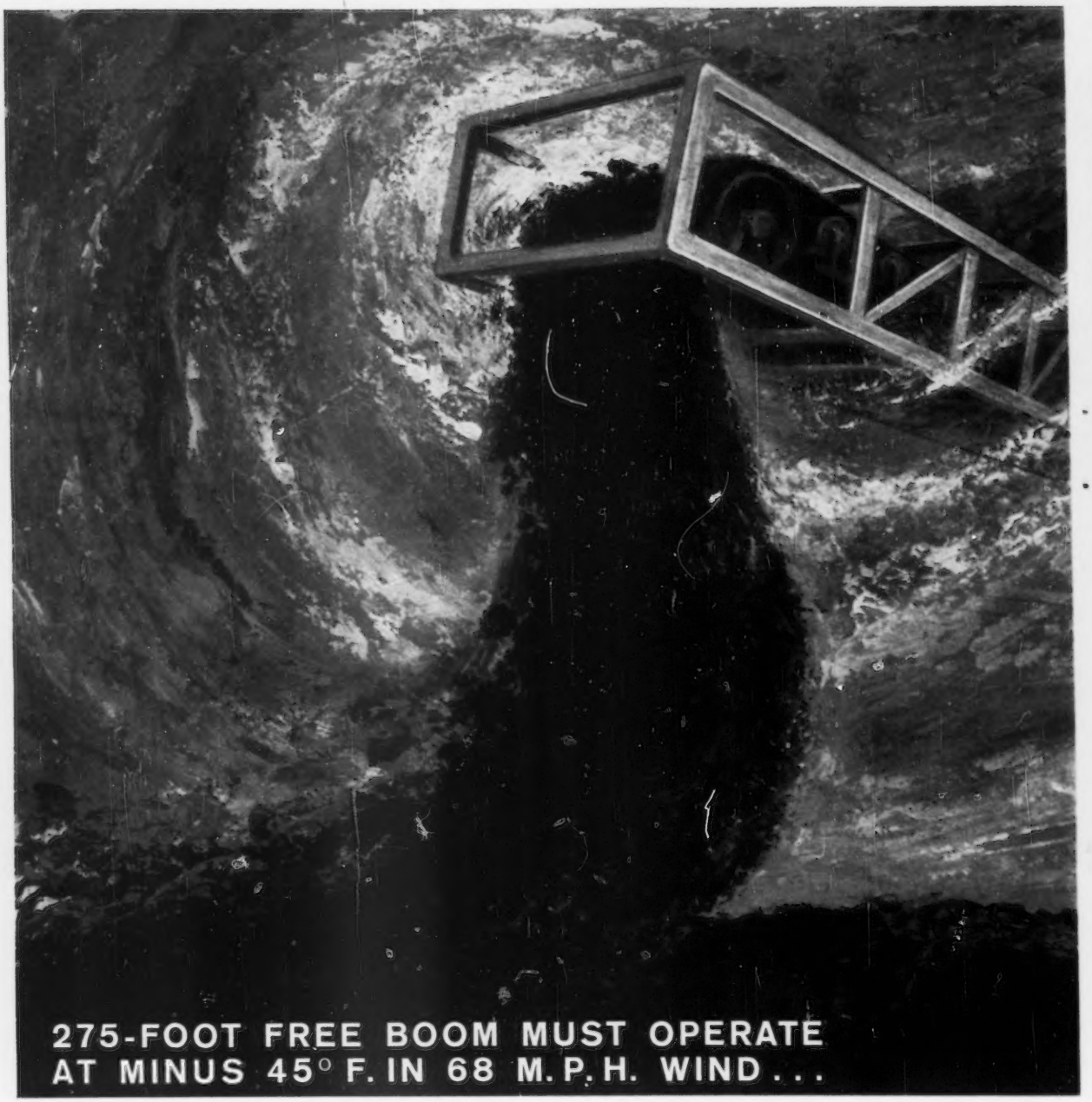


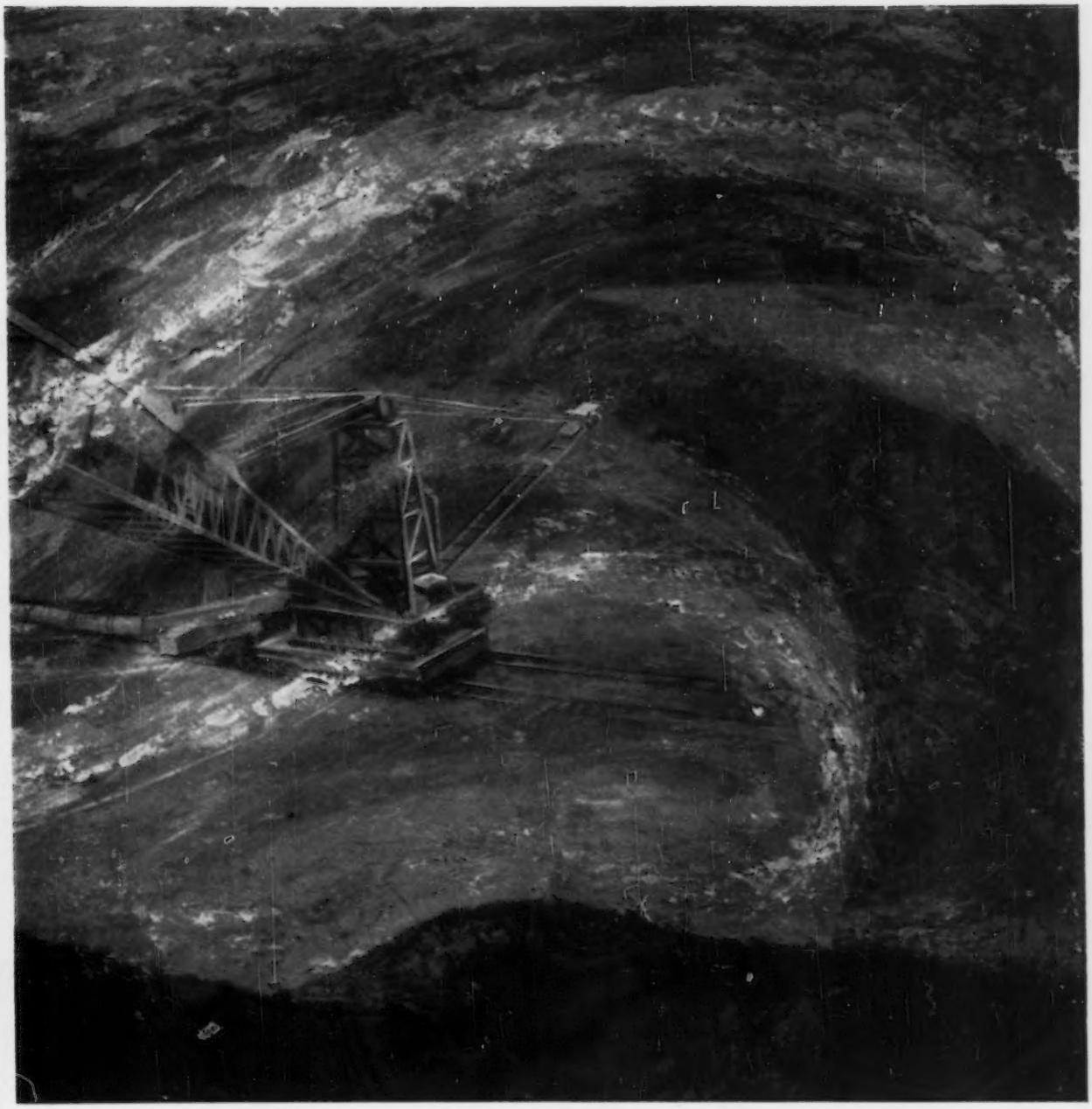
What structural steel would you

Erie Mining Company played it safe . . . OK'D Mayari R* a nickel-copper high strength low alloy steel – for chord members in the 275-foot boom and 90-foot mast of this ore stacker.

What does this nickel-containing steel have that justifies such confidence?

The nickel-copper high strength low alloy steel has superior tension-impact properties at low temperatures . . . far superior to structural carbon steel. It provides extra strength (50,000 psi minimum yield strength in the as-rolled condition) and corrosion resistance. All this adds up to maximum structural safety with minimum weight.

The superior properties of steels like this are derived in part from improvements that nickel makes in the structure of the metal.



approve for conditions like these?

Nickel-containing high strength low alloy steels have just the combination of properties you need to insure strong, safe mine structures. A new manual, "Nickel-Copper High Strength Low Alloy Steels," goes into details on their properties. Write for your copy.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street INCO New York 5, N. Y.

*Registered trademark of Bethlehem Steel Co.

INCO NICKEL

NICKEL ALLOYS PERFORM BETTER LONGER

TD-24 "strips" at lowest of any crawler on the

reports Morris Enterprises, Owensboro, Kentucky

Upgrade, downgrade, or on the level, famous Planet Power steering gives you positive and constant load control on turn or straightaway. And this planetary system that gives full-time "live" power on both tracks lets the TD-24 pull the same big loads on turns as on straightaways! Morris Enterprises owns this TD-24 that's stripping overburden near Knottsville, Ky.

Benching or 'dozing around curves is a cinch for the TD-24. TD-24 two-track turning power never backs off from the load—and does not let the load "fish-tail" the tractor or slip the tracks! Instead you "feed" power to both tracks to keep the full productive push where you want it!

cost per cu yd market...

On this stripping operation near Knottsville, Kentucky, Morris Enterprises are moving a maximum of 45 feet of overburden—to uncover a 42-inch coal seam. Overburden is a 5 to 10-foot earth layer; the balance, shale and soapstone.

An International TD-24 dozer is moving 50% of the overburden on a 60 to 70-foot wide cut ahead of shovel operation. A 3½-cu. yd. shovel moves the other 50%.

"This kind of performance sold me"

"Have been using International TD-24's since 1950," reports P. H. Morris, for Morris Enterprises. "The TD-24 has proven able to move dirt cheaper per cu. yd. than any other track-type tractor. Upkeep has been low and TD-24 ease of operation enables the operator to maintain full production—after hours of continuous dozing.

"Live power on both tracks while turning is a definite advantage for full load maneuverability. And shifting on-the-go speeds up the production.

"One of the TD-24's ran 7,500 hours before major overhaul on rails, shoes, and engine. Still in use with original rollers and sprockets.

"This kind of performance sold me on TD-24's for my operation."

See how you 'doze bonus yardage on the turns—stay "on course" with offset loads—keep positive load control, upgrade or down, with TD-24 Planet Power steering to eliminate "dead-track drag." Prove the cycle-speeding advantages of exclusive Hi-Lo shifting—for adjusting the speed to the load—for gaining capacity-adding reverse speed on shuttle dozing. Compare International's Cerametallic-faced engine clutch—for power-transfer efficiency—operating and servicing ease—long life! See your International Construction Equipment Distributor for a TD-24 demonstration!

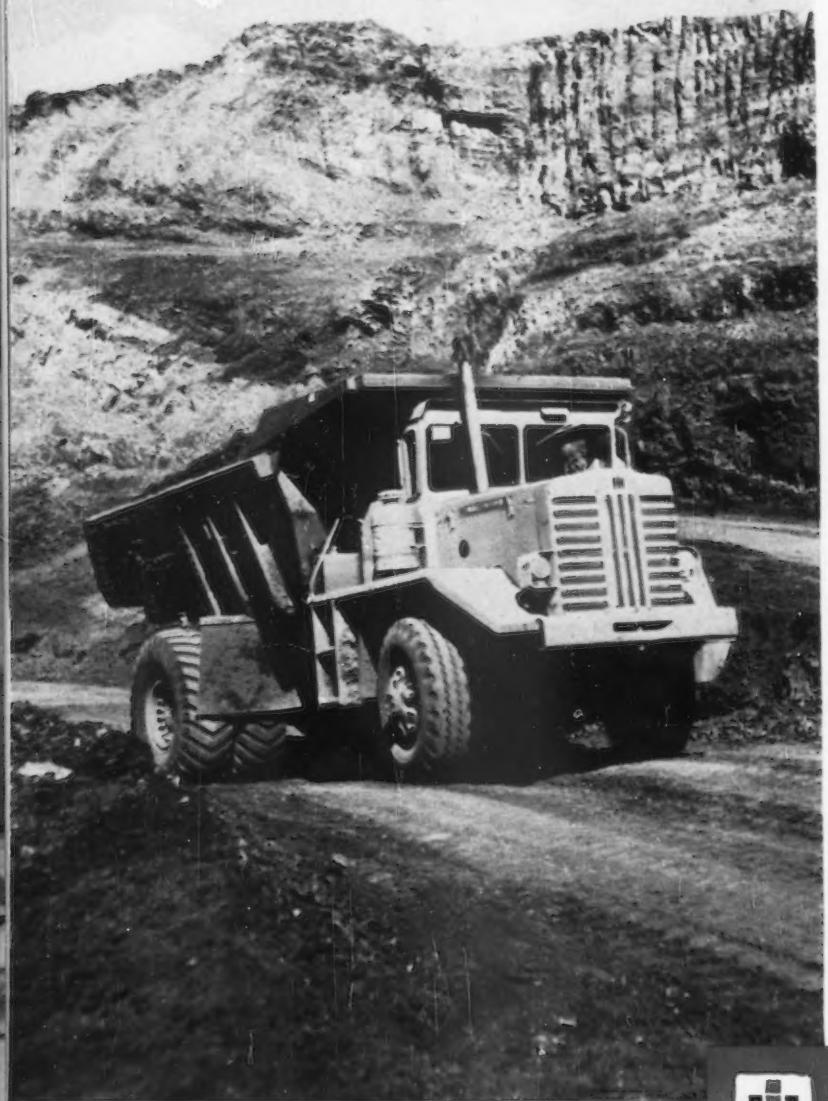
International® Construction Equipment

International Harvester Co., 180 N. Michigan Avenue, Chicago 1, Illinois

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

"95" Payhauler® beats trailer units by up to 50 seconds...

in 20% grade climb-outs!



Phosphate mine superintendent reports "95" gains up to 100 cu. yd. daily!

A bonus-powered International "95" Payhauler®, in carefully timed tests, climbed the winding 20% grade, up to 50 seconds faster than competitive crawler-pushed trailer units!

The Payhauler, and the two "articulated" hauling units, bring out 18 cu. yd. loads apiece at the Simplot Corporation's phosphate rock mining operation near Blackfoot, Idaho.

Supt. Robert Bulard reports: "The Payhauler gains approximately 100 cu. yd. daily over our other 18 cu. yd. haul units. Not only does it have greater speed, but the Torqmatic braking gives it greater safety as well. This morning, light rain made pit roads so slippery all equipment quit except the Payhauler. It never missed a load."

Power on Payhauler rear wheels delivers top operating efficiency on steep grades or under "slick" conditions where trailer units bog down completely. Prove the fast get-away surge, the extra climbing power, and up to 25% faster haul speed of an International Payhauler. That's the exclusive result of bonus turbo-charged diesel power; road-matched and load-matched gear choice; and the power-cushioning leverage of planetary drive axles!

Try Payhauler "pick-up truck" spotting ease. Exclusive high reverse speed, "zip-around" power steering, and grade-beating power get the credit! See how 12-second dumping with double-acting hydraulic hoist speeds the cycle. See your International Construction Equipment Distributor for a Payhauler demonstration.

International Harvester Co.
180 N. Michigan, Chicago 1, Ill.

Gentlemen:

☐ I am a contractor. ☐ Am an equipment operator (please check square that applies). Send me Payhauler Catalog (CR-603-G).

Name_____

Street Address_____

City_____ State_____

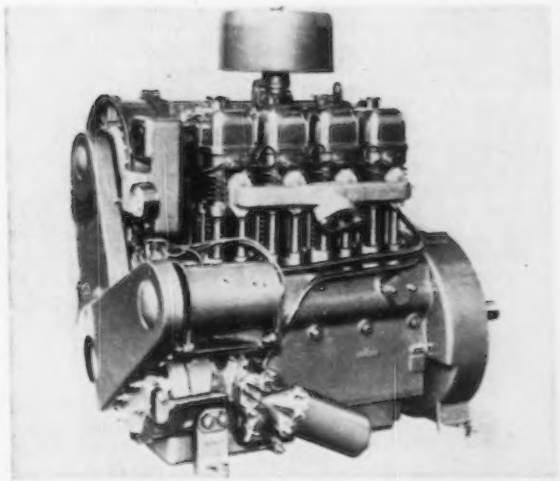
International®
Construction
Equipment

International Harvester Co., 180 N. Michigan Avenue, Chicago 1, Illinois

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors... Self-Propelled Scrapers... Crawler and Rubber-Tired Loaders... Off-Highway Haulers... Diesel and Carbureted Engines... Motor Trucks... Farm Tractors and Equipment.

E&MJ NEW PRODUCTS DIGEST

With this issue, New Products Digest takes on a new format with four full pages assigned to new products, plus the four columns on the reply card that are set aside for new literature announcements. Each month, from 100 to 112 items will appear on these pages.



Lightweight Small Diesel Runs at 3000 RPM (1)

Petters Ltd. has introduced the PC Series of small, lightweight, low-cost, high-speed diesel engines in one, two, three and four cylinder sizes. Single cylinder unit weighs 243 lb, develops 6.25hp. Four cylinder weighs 503 lb, develops 25hp. These engines will be distributed outside England by Brush Aboe, Inc. Mr. D. K. Fraser, managing director, Petters Ltd., pointed out that these units are already in use as power sources for many small industrial and marine jobs. Company policy is never to sell an engine in a country where servicing and spare parts are not available.

Brush Aboe, the parent company, recently installed the large diesel-generating plants for Inco's Moak-Mystery Lake operation.

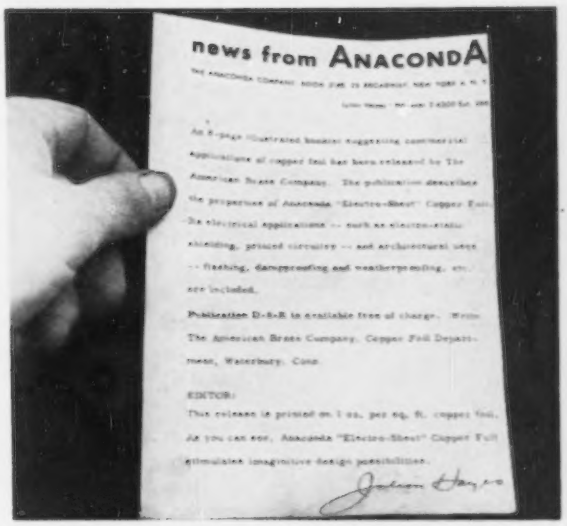
Resin Spray Keeps Down Stockpile Dust (2)

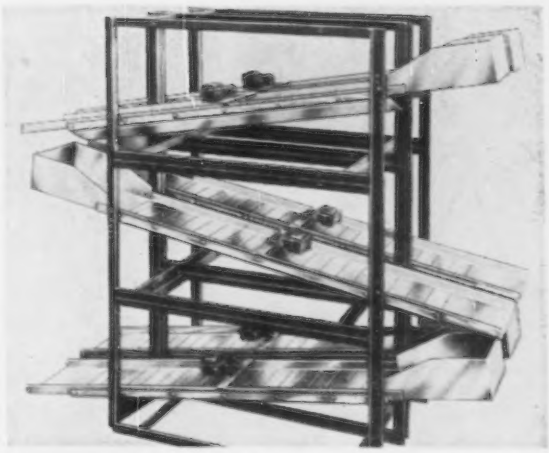
Reagent S-3152 is a water emulsion of a synthetic resin which will form a protective wind and rain erosion resistant coating on exposed mineral fines. Can be used in stockpile or open box cars. According to American Cyanamid Co., R-3152 can also be used to keep down the dust on tailing piles, roadways or airstrips. Reagent is non-corrosive and appears to be non-toxic to small animals.

Wire and Cable Manual Published by Rome Cable

Second edition of this 393-page "bible" of the wire and cable industry is now available from Rome Cable Corp., Rome, N. Y. Some extensive and completely new data, new information and illustrations have been added to bring the manual up to date. This is not a free literature notice. Write direct to the company at Rome, N. Y. *Wire and Power Cable Engineering Calculations and Data* is sold for $4.62 postpaid.

For more information on these items and for copies of the free literature listed on the reply card opposite page 44, circle the proper numbers, give your name and address and mail to E&MJ



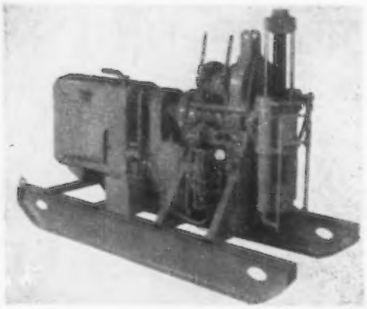


Gravity Concentrating Sluices For Fine Heavies (3)

T&R Classifier-Concentrator can be used to concentrate, classify, upgrade or deslime through a combination of vibration, specific gravity and a reverse riffle. Unit is of stainless steel construction with each tray weighing 150 lb. Trays are 86 in. long by 16 wide, according to Bush Engineering & Mfg. Co.

Mobile Sand Classifier For Highway Travel (4)

Eagle Iron Works has introduced a series of sand washing, classifying and dewatering portable units. Units can be hauled from pit to pit, using highways. Unit operates on gasoline or diesel engine, ships side panels for travel. Capacities to 200 tph concrete sand available.



Skid-Mounted Core Drill (5)

Pennsylvania Drilling Co. has started production of the "JS" core drill, designed with a low center of gravity and wide skids for maximum stability on rough grounds. Motor is 34hp, liquid cooled. Unit will take Diamond Core Drill Manufacturer's Association "W" drill rods.

Electronic Metal Detector (6)

Automatic balance control is a feature of the Twin Loop electronic metal detect developed by Stearns Magnetic Products. Can be installed on any conveyor handling non-magnetic materials. Unit will detect tiny particles of metal at belt speeds of from 30 to 600 fpm. Special sizes and shapes can be made to suit your purpose.

Concrete Gunning Machine (7)

Airplaco gunning machine, developed by Air Placement Equipment Co., can gun at the rate of 9 cu yd per hr. Available with air plant, or your air system may be used if of sufficient volume.

Wire Rope Cutter (8)

Tulloch Construction Co. is making three sizes of the Tullcon cutter to cut rope ⅝-, 1- and 1½-in. dia. Cutter severs rope cleanly without flattening or distorting the braid. Heavy hammer or sledge is the only tool needed.

Stationary Air Compressor (10)

Model AR-3, by Atlas Copco Eastern, Inc., has a free air delivery ranging from 570 to 680 cfm at 100 psi and is available for permanent installation or as a skid-mount. Other models in the AR series will deliver from 330 to 3,220 cfm at 100 psi.

Kwik-Mix Moto-Bug (9)

Unit can carry 1½ tons in an 18 cu ft hopper when used as a platform carrier, and can raise 1500 lb to 7 ft when used as a fork truck. Moto-Bug will climb a 25% grade, says Kwik-Mix Co.

Safety Aids

Supergard safety hats and caps are now available with the No. L-1 Universal Lamp Bracket, which fits all types of Edison, Wheat and Carbide lamps. According to Fibre-Metal Products Co., hats are made of tough, lightweight polyester resin and are approved by the Coal Mine Compensation Rating Bureau of Pennsylvania. Mounting clips can be purchased for attachment to other make hats already in service. **(11)**

Portable air-oxygen mask and resuscitator combination unit available from Fyr-Fyter Co. provides equal protection for both rescuer and victim. Dualife unit weighs 39 lb and contains 52 cu ft of gas, enough to last 40 minutes as a combination feed. **(12)**

Cotton work clothes will wear an average of 70% longer when fortified with a new type of nylon developed by Du Pont Co. **(13)**

Urethane foam pads can protect the ears from extreme noise encountered in drilling, blasting and crushing, says the Du Pont Co. Cellular urethane protects against high and low frequency sound, but permits the wearer to hear ordinary conversation. **(14)**

Thousands of tiny non-skid plastic dots embedded in the Riegel Textile Corp. glove fabric provide a tough, featherlight, nonskid industrial glove surface. **(15)**

Hose, Wire and Cable

Boston industrial water hose is primarily designed to handle the varied industrial water discharge required with maximum economy. Boston Woven Hose & Rubber Co. says that Boston performer air-water hose, another product, is applicable for moderate pressure water service, and air service where oil resistance is not a factor. **(16)**

High-pressure wire-braided air hose available from Acme Rubber Manufacturing Co. will withstand working pressures up to 1500 psi. Acme Gold Seal air hose is available in ID sizes from ½ to 2½ in. **(17)**

Wire-braided steam hose for 200 psi service is offered by Hamilton Rubber Manufacturing Corp. Known as Gibraltar hose, it is recommended for saturated steam pressures to 200 psi or for superheated steam to 385 deg F. Sizes run from ½ to 2½ in. ID. **(108)**

Working pressures up to 400 psi air and 2000 psi water are specified for Thermoid Co.'s Thunderbird flexible wire braid hose. Ten different sizes from ⅜ to 4 in. can be had. **(109)**

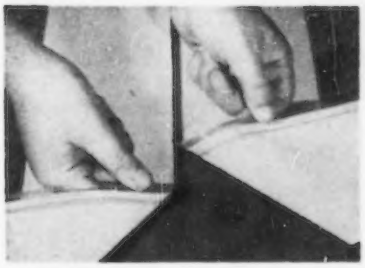
Simplex Wire & Cable Co.'s Simplex C-L-X, the continuous, exterior, corrugated-metal sheath, provides a completely sealed conduit with a built-in cable. Cable and conduit combination is rugged, lightweight and flexible. **(110)**

Hydraulic Controls

Five-way, hydraulic control valve, Model 1776 designed by Mechanisms Co., is just the thing for complicated hydraulic control circuits on earthmoving equipment, says the company. Standard valve is suitable for pressures up to 2000 psi, but special orders for higher pressure will be filled. **(48)**

Hydraulic directional control valves for earthmovers and material handling equipment are available from Parker Appliance Co. Recommended operating pressure is up to 2000 psi. **(49)**

Three-way, midget solenoid valves for ⅛ and ¼ in. pipe fittings and working pressures from 0 to 300 psi are available in four constructions from Automatic Switch Co. Only one moving part. **(50)**



Filter Bags With Zippers (18)

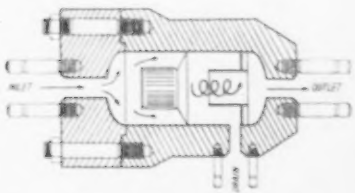
Filtration Fabrics Div., Filtration Engineers announces that custom-tailored filter cloth bags are available with polyethylene zippers that can be sewn to any kind of fabric. Zippers are jamproof.

Dust Collector Valve (19)

Continuous, trouble-free performance is assured, says Ducon Co., Inc., with their Trickle Valve that uses a patented ring-type hinge to allow dust to discharge from dry cyclones or other dry collectors, yet prevents gas leak.

Silent Electric Vibrator (20)

Cleveland Vibrator Co. recently announced that they had redesigned Model RC-50 vibrators, used on bins, chutes and hoppers. Unit is more powerful, has new heavier wiring, yet is silent. No reciprocating parts and only one moving part—the motor.



High Pressure Purifier (21)

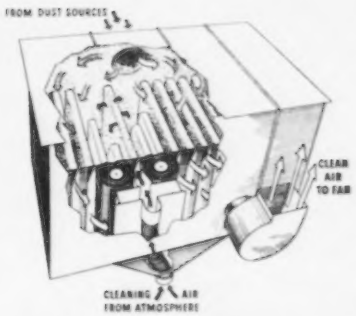
V. D. Anderson Co. has developed an air, steam, gas or process vapor purifier designed to withstand 15,000 psi. Carefully controlled centrifugal force guides entrained vapor through a series of vanes and baffles. Unit is two-stage, with first stage removing large droplets and second stage accounting for the mist.

Mine Car Rapper (22)

To speed unloading of bottom-dump mine cars, Syntron Co. has designed their Fluid-Power car rapper with a holding magnet. Operated on oil pressure from a closed circuit pump, the rapper delivers 300 sharp blows per minute.

Side Entry Turbo-Mixer (23)

Standard side-entry propeller mixers can be readily serviced, according to Turbo-Mixer Div., General American Transportation Corp. Stuffing box can be repacked or the seal replaced without interrupting storage tank program.



Sly Roll-Clean Dynaclone (24)

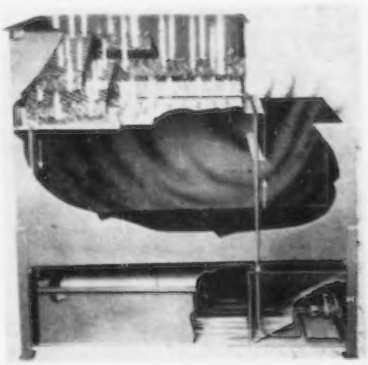
In operation, the Sly Dynaclone uses rubber rollers that move back and forth, sealing off the ends of each bag in turn as the bag is cleaned while the rest of the bags are collecting dust and cleaning air. Any one bag can be changed without disturbing the other bags.

Aluminum Melting Furnace (25)

Tilting reverberatory, gas or oil fired, aluminum melting furnace can be easily charged, fluxed, alloyed or cleaned. Furnaces will hold, according to size, 1000, 1700, 2500 and 3000 lb, says Stroman Furnace and Engineering Co.

Bucket Elevator (26)

Carpco Manufacturing Inc. says that their Carpco elevators are available in three bucket sizes—3x3, 6x4 and 8x5 in. Capacities range from 4,800 lb (50 cu ft) to 82,800 lb (150 cu ft) per hr.



Oil-Bath Dust Collector (27)

P-17 Cycoil is an automatic, self-cleaning dust collector that separates dust from air as it passes through a viscous crimped-wire, fluid bed pad. American Air Filter Co., Inc. says that this unit makes an excellent aftercleaner to follow a dry or wet collector.

Sliding Belt Conveyor (28)

Carpco Manufacturing Inc.'s conveyor can handle up to 22,500 lb/hr, and is available in 6 and 12 in. belt widths. Conveyors are also available with magnetic pulleys mounted at the discharge end to remove tramp.

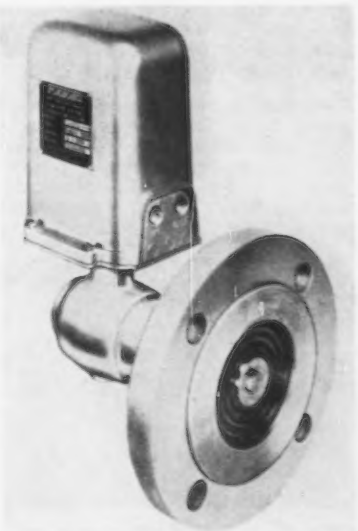
Large Balling Drum (29)

Hardinge Co., Inc. has just delivered two large balling drums for sintering operations—one measured 12 ft inside diameter by 40, while the other was 50 ft long. Unit was machined and shipped as a single unit.

Automatic Thickener (30)

Fitted with a completely automatic raising and lowering mechanism, Denver Equipment Co.'s high capacity thickener is designed to take advantage of improved flocculants for increased settling rates.

Process Control Aids



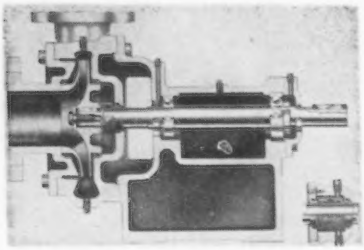
Differential pressure liquid level transmitter. Type 13FA d/p Cell Transmitter, mounts directly on a tank nozzle to provide a simple measuring aid for viscous or slurry-type liquids in open or closed vessels, says Foxboro Co. **(97)**

Low-cost data processing instruments for quick and easy processing and interpretation of seismic data is now available from Texas Instruments Inc. VIP (Variable Intensity Plotter) offers central office advantages in a portable unit. **(98)**

Fully-transistorized computer-data processing systems engineered by Beckman Instruments, Inc. can be used to record process variables on a round-the-clock basis, then use that information to insure peak process control. **(99)**

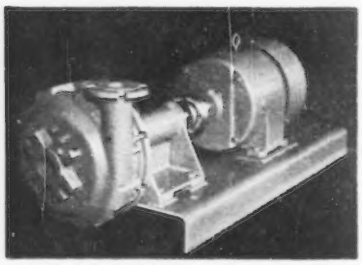
Multiple-record strip-chart telemeter receiver developed by Bristol Co. can print out 16 separate records from as many telemetering centers. Variables need not be of one kind, but can be any combination of temperature, pressure, flow or level. **(100)**

Control for sensing low pressure, vacuum or differential pressure in the 0.05 to 40 in. water column range is available from Henry G. Dietz Co. Controls are suitable for air, gas, water or liquid when using pressure connection. **(101)**



New line of high-speed, high-head centrifugal pumps for general water service are available from Gardner-Denver Co. Model BH pumps come in four sizes—1-in. (150 gpm), 1½-in. (220 gpm), 2-in. (440 gpm), and 3-in. with 520 gpm capacity. Bronze impeller is used with stainless steel shaft. **(31)**

Two-stage, general purpose centrifugal pumps, class GT, with capacities to 3500 gpm, pressures to 450 psi, heads to 1100 ft that will operate at temperatures up to 300 deg F are discussed in Ingersoll Rand's 15-page bulletin. Form 7062-C. **(32)**



Medium-range, high-speed slurry pump —known as Type BA—has been introduced by Morris Machine Works to handle sand, coal, crystals, silts, sludge or chemical process slurries. Pump comes in 1-, 1½-, 2-, 3-, and 4-in. sizes. Available in cast iron, Ni-hard or stainless steel. **(33)**

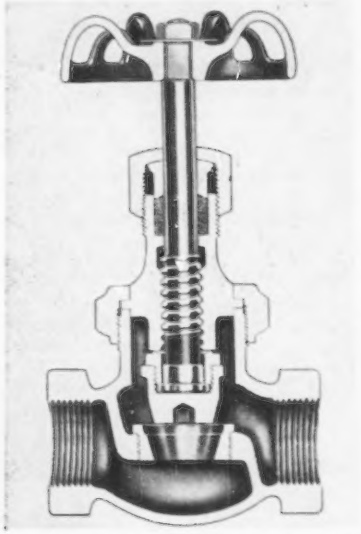
Series of single-stage, end-suction, centrifugal pumps, designated "H" series, are manufactured by Nagle Pumps, Inc. Three types of water-ends are available —abrasive handling, corrosive and a third designed to handle either abrasive or corrosive feed. Size from 1- to 16-in. with heads up to 250 ft available. Capacity goes up to 10,000 gpm. **(34)**

Self-priming contractors' pumps in the centrifugal design are available from Worthington Corp. Model 4M is corrosion-resistant aluminum, weighing only 45 lb. Eight other sizes are produced. **(35)**

High-capacity, 50hp submersible water pumps have been added to the Sump Pumps, Inc. line. Size range now goes from ½ to 50hp. The 8-in. model will deliver up to 420 gpm with total heads as high as 600 ft. Ten inch model in 15-, 30-, or 50-hp design delivers up to 640 gpm. **(36)**

Positive displacement pump with rubber rollers acting as roller vanes has been demonstrated by Hypro Engineering, Inc. Pump can deliver up to 95 gpm at 700 rpm attached directly to a gear-reduced motor or engine. **(37)**

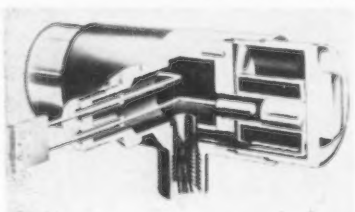
Pneumatic sump pump, Model VP-8, was designed by Gardner-Denver Co. for 250 gpm capacity at heads to 280 ft. Pump is air-motor driven. Unit weighs 110 lb, will fit in 11x13 in. opening. **(38)**



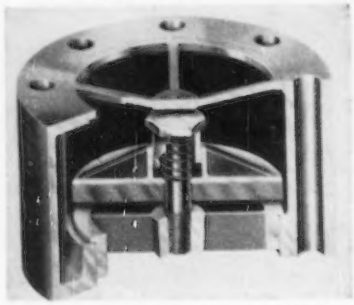
Plug type globe and angle valves with 500-plus Brinell hardness stainless steel seats and discs are available from Ohio Brass Co. Valves come in both 150 and 200 lb working steam pressure classes. Recommended for close throttling of steam, water, oil or air. Sizes range from ¼ through 2 in. **(39)**

Pressure reducing valves are now being supplied by Atlas Valve Co. with stellited main valve. Pilot valve and pilot seat are also stellited. Atlas Type B is a spring-loaded, piston-operated valve actuated by an internal pilot. Designed for inlet pressures to 1500 psi at 900 deg F. Will reduce to as low as ½ psi in one step. Sizes from ½ to 6 in. **(40)**

Automatic line oiler which shuts off the air supply immediately when the oil has been used up are now manufactured by Le Roi Div., Westinghouse Air Brake Co. Tank holds one pint of oil. **(41)**

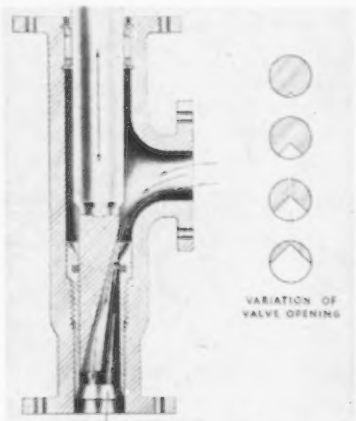


"Dynatrol" level control, manufactured by Automation Products, Inc., can accurately detect and control high or low point of a liquid, solid or slurry. Output signal can be used to control any electrical equipment. Unit is rated 3000 psig, explosion proof, corrosion resistant, for mounting in any position with ¾ in. NPT pipe. **(47)**



Spring-loaded check valves can eliminate surges in fluids, drop-back and false meter registry, says Combination Pump Valve Co. CPV check valves are easy to install and will operate in any position. Standard sizes from 2 to 18 in. with pressure range up to 2500 psi can be had. **(42)**

Medium-duty plug valves furnished by Ledeen Mfg. Co. are designed for use with air, gas, water or oil at pressures up to 200 psi. Three models available. **(43)**



Tapered orifice valve is said to be a radically new valve type, according to General-American Valve Co. Suitable for fluid or gas flow control, the tapered design is basically a needle valve. Valve is virtually clog-free, passing gas or fluid through a triangular section rather than around an annular ring. **(44)**

Top-guided, bronze pop safety valves for steam generator service and air or gas use at set pressures to 300 lb at 450 deg F have been developed by Farris Engineering Corp. Sizes range from ½ to 3 in. male inlet, female side outlet. Valve is ASME approved for power boiler and unfired PC codes. **(45)**

Top-guided-semi-nozzle, cast iron safety valves for steam generator service are manufactured by Farris Engineering Corp. Choice of 21 nozzle and seven body sizes from 1½ F2 to 6S8 are available offering maximum pressure service at 250 psig at 450 deg F. Trim is bronze or stainless steel. **(46)**

E&MJ NEW PRODUCTS DIGEST (*Continued*)

For More Details on New Product Items Starting on p35 and For Copies of Free Literature Listed Below –Circle the Proper Number on Card. Be Sure to Give Your Name and Address, Then Mail to *E&MJ*

For Your Files

This selected manufacturers' literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

Mining

SEVEN KEYS TO WELDING PROFIT is the title of an eight-page two-color bulletin presented by Caterpillar Tractor Co. Bulletin stresses reliable Caterpillar power, two steady arcs, dual controls, parallel power, diesel economy and portability. **(52)**

CRAWLER TRACTOR, International TD-24 torque converter or gear drive design, is the subject of a 20-page catalog prepared by International Harvester Co. TD-24 is a 4-cycle, 6-cylinder, 202hp diesel. **(53)**

POWER SHIFT torque converter drive for fork lift trucks is covered in Allis-Chalmers Manufacturing Co.'s bulletin, BU-465. 8 pp. **(54)**

SIDE DUMP BUCKET for Caterpillars are illustrated in 4-page brochure from Caterpillar Tractor Co. **(55)**

Auxiliary Equipment

FLEXIBLE CONNECTIONS for conveying liquid, gas or slurry, can be examined in Cobra Metal Hose's 4-page release. Price list is included. **(56)**

EQUIPMENT LUBRICATION recommendations by Whitmore Manufacturing Co. are set down in a folder now available. **(57)**

HOW TO SELECT and size temperature control valves is a 6-page bulletin published by Jordan Industrial Sales Div., OPW Corp. **(58)**

ELECTRONIC RESISTANCE THERMOMETER developed by Barber-Colman Co. is illustrated in two-page flyer. **(59)**

SPEED VARIATORS catalog bulletin prepared by General Electric Co. contains 15 pages of design and application. Slide-rule motor selector is included. **(60)**

DUR-X NYLON FITTINGS for plastic pipe use have been developed by Franklin Plastics, Inc., according to latest company release. Fitting sizes run from ½ to 2 in. **(61)**

ZIPPERTUBING can protect groups of wires, tubes, pipes and hoses from abrasion, corrosion and excess wear. Device is a plastic jacket with a special zipper type closure, according to company literature. Zippertubing Co. says jacket is available in sizes from ⅜ in. and larger in ⅛ in. increments. **(62)**

SOLENOID VALVES and electromagnetic controls by Automatic Switch Co. are detailed in 4-page condensed catalog. **(63)**

ALUMINIZED ASBESTOS safety clothing is described in 4-page illustrated bulletin prepared by Mine Safety Appliances Co. Clothing is designed for that "hot spot" job—coking, slagging, furnace repair, tap-out. **(64)**

SILASTIC—the Dow Corning silicone rubber—is illustrated in a 4-page bulletin. Electrical properties and applications are cited. **(65).**

SILICON CARBIDE technical bulletin published by Carborundum decribes the characteristics of KT silicon carbide alloy. 4 pp. **(66)**

FITTINGS are available for lightweight rolled-groove tubing, according to Victaulic Co.'s latest release. **(67)**

SOLID AND OPEN steel flooring—five different types—for floors, stairs, steps and walkways are covered in Joseph T. Ryerson & Son, Inc.'s latest 8-page bulletin 50-9. **(68)**

REFRACTORIES, the publication of Refractories Div., Carborundum Co., presents 8 pages of illustrations, detail and application on refractory tubes and cylinders in the October issue. **(69)**

SIZING CHART for OPW-Jordan sliding gate and plate regulating valves is 6 pages. Bulletin J-SC. **(70)**

USE OF ALUMINUM for tanks and vessels is set down in a 15-page booklet prepared by Reynolds Metals Co. It lists more than 100 chemicals for which aluminum applications are of particular advantage. CP 15-10757. **(72)**

E&MJ NOT GOOD AFTER JULY 1, 1958

Please send me the catalogs or futher information about the items from New Products Digest whose numbers are circled. **JAN. 1958**

1	17	33	49	65	81	97
2	18	34	50	66	82	98
3	19	35	51	67	83	99
4	20	36	52	68	84	100
5	21	37	53	69	85	101
6	22	38	54	70	86	102
7	23	39	55	71	87	103
8	24	40	56	72	88	104
9	25	41	57	73	89	105
10	26	42	58	74	90	106
11	27	43	59	75	91	107
12	28	44	60	76	92	108
13	29	45	61	77	93	109
14	30	46	62	78	94	110
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16	32	48	64	80	96	112

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E&MJ NEW PRODUCTS DIGEST (*Continued*)

CUSHIONED VALVES in action is the title of Golden Anderson Valve Specialty Co.'s latest 4-page bulletin showing applications. **(73)**

HOW B. F. GOODRICH Armorite is used as a liner, curtain, throw mat or pad for protection against abrasion is the subject of a 4-page bulletin. **(74)**

BRASS HOSE FITTINGS, a new 8-page bulletin prepared by Hose Accessories Co., describes fittings for low or medium pressure service in conveying air, spray, steam, suction of water. **(75)**

KENPLATE TUNGSTEN CARBIDE SURFACING, Kennametal Inc.'s latest development, is illustrated in 4-page bulletin. Tungsten carbide hexagonal buttons are assembled on a backing material that you can cement in place to form a ball mill liner, chute or feed box liner. **(76)**

PULLING AND LIFTING units with continuous steel rope are detailed in Tirfor's 6-page bulletin. **(77)**

FOR POWER AND LIGHTING SERVICE, Triangle Conduit & Cable Co. Inc. recommends Triangle Type RR cable, which is detailed in a 4-page release. **(78)**

HEAVY-DUTY DRIVE introduced by H. W. North Co. are illustrated in a 4-page brochure. Developed for all kinds of heavy rotating machinery at low or medium speeds in both parallel or right angle types, these drives are offered in ratings up to 1500hp. **(79)**

MONO SEAL, a synthetic resin protective coating, is described in detail in Mono Seal Products' 12-page bulletin. 23 different colors possible. **(80)**

WELDED STEEL PIPE from Armco Drainage & Metal Products, Inc. is illustrated in a new 8-page bulletin. Advantages and operating data are listed. **(81)**

DRIVES AND MOTORS engineered and built by Reliance Electric and Engineering Co. are presented in a 12-page two-color booklet. **(82)**

SYMONS ROD DECK SCREEN is available in five larger sizes, according to Nordberg Manufacturing Co.'s latest bulletin. Multiple screening action and patented screening surface are featured in 8 pages. **(83)**

CAST IRON GATE VALVES features are illustrated in Walworth Co.'s 4-page bulletin. Weight chart and line drawings for each type are included. **(84)**

GAS SCRUBBING SYSTEMS developed by Process Equipment Division of Automotive Rubber Co., Inc. are available in two designs. Cyclonic Jet and Jet Impactor, according to 4-page bulletin showing cutaways and typical installations. **(85)**

ROTARY KILN DESIGNS that simplify foundation plans, avoid frictional wear, reduce power load and cut down time are introduced in 4-page release from Vulcan Iron Works. **(86)**

SWECO VIBRATING SCREEN features are portrayed in Southwestern Engineering Co.'s 4-page bulletin. Unit described is the 30-in. Sweco. **(87)**

LEAD-ZINC FLOTATION flowsheet at Consolidated Mining and Smelting Co., Ltd.'s H. B. Concentrator, Salmo, B. C., is fully described in Denver Equipment Co.'s 8-page, illustrated article. **(88)**

FATTY ALCOHOL data sheet for Cachalot, M. Michel and Co., Inc.'s trade name product, is a one-page release with suggestions on the use of these lauryl, cetyl, stearyl and oleyl alcohols. **(89)**

FLOCCULANT filter aid—Burtonite—is discussed in 2-page release from Burtonite Co. Paper suggests using Burtonite as a gangue depressant. **(90)**

MUFFLES for high temperature sintering furnaces are being custom-made by Wiretex Manufacturing Co. Units are produced to meet your specifications of temperature, gas and atmosphere. **(91)**

SWECO STEAM jet ejectors to meet vacuum requirements of power and process metallurgy are presented in Southwestern Engineering Co.'s 8-page chart and table bulletin. **(92)**

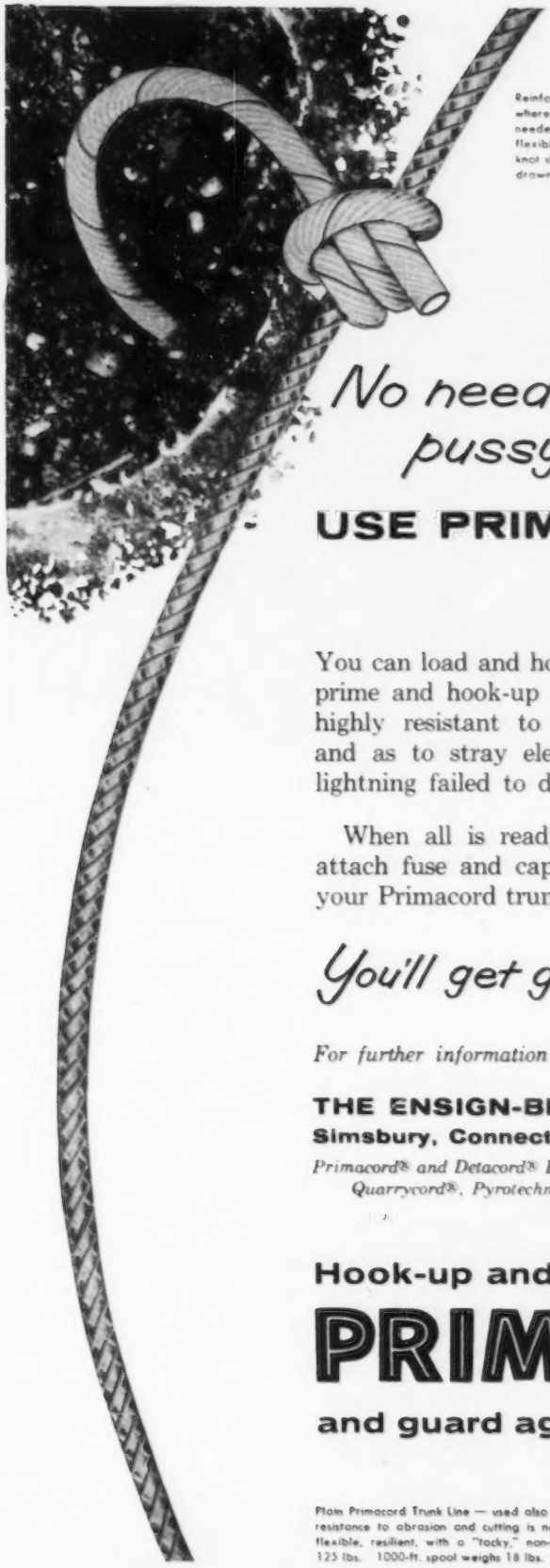
CHEMICALS manufactured by Industrial Chemicals Div., Olin Mathieson Chemical Corp. are illustrated as to character, grade and package in a 16-page booklet. **(93)**

BELT CONVEYOR SYSTEMS installed in industry by Stephens-Adamson Manufacturing Co. are presented in 16-page bulletin. **(94)**

HIGH FREQUENCY induction furnaces for laboratory use are illustrated in Lindberg Engineering Co.'s 12-page catalog. **(95)**

METAL GRATING HANDBOOK—design manual prepared by the Metal Grating Institute for architects, engineers and builders, contains 32 pages of informative text, drawings, tables and photographs. Not a manufacturers catalog, but a technical guide. This is not a free literature notice. Price is $1. Write, send money direct to the Metal Grating Institute, Inc., One Gateway Center, Pittsburgh 22, Pa.

SIF-TIPS is a quarterly welding journal published by Suffolk Iron Foundry Ltd. Each issue of this small booklet contains some 20 pages of operating ideas and techniques. Price is sixpence each issue. This is not a free literature notice. Write to Suffolk Iron Foundry Ltd., Stowmarket, Suffolk, England.



Reinforced Primacord Branch Line — recommended for deep holes where normal strength and resistance to abrasion and cutting are needed. Textile reinforced (yellow with red thread), tough, resilient, flexible. Tensile strength 160 lbs. 1000-ft spool weighs 19 lbs. The knot shown is the double-wrap half hitch, made in the branch line and drawn tightly around the trunk line.

No need to pussyfoot...

USE PRIMACORD

You can load and hook-up *well ahead* of the blast when you prime and hook-up with Primacord detonating fuse. It is highly resistant to vibration, friction, impact, sparks — and as to stray electrical currents, even a direct hit by lightning failed to detonate Primacord.

When all is ready for the blast — then and then only attach fuse and cap or electric blasting cap to the end of your Primacord trunk line.

You'll get good digging

For further information see your explosives supplier or write to

THE ENSIGN-BICKFORD COMPANY
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Primacord® and Detacord® Detonating Fuse, Safety Fuse, Ignitacord®, Quarrycord®, Pyrotechnical Devices and Blasting Accessories

Hook-up and detonate with

PRIMACORD®

and guard against *Stray Current* hazards

Plain Primacord Trunk Line — used also for shallow holes — wherever resistance to abrasion and cutting is not required. Textile covered, flexible, resilient, with a "tacky," non-slip surface. Tensile strength 125 lbs. 1000-ft. spool weighs 18 lbs.

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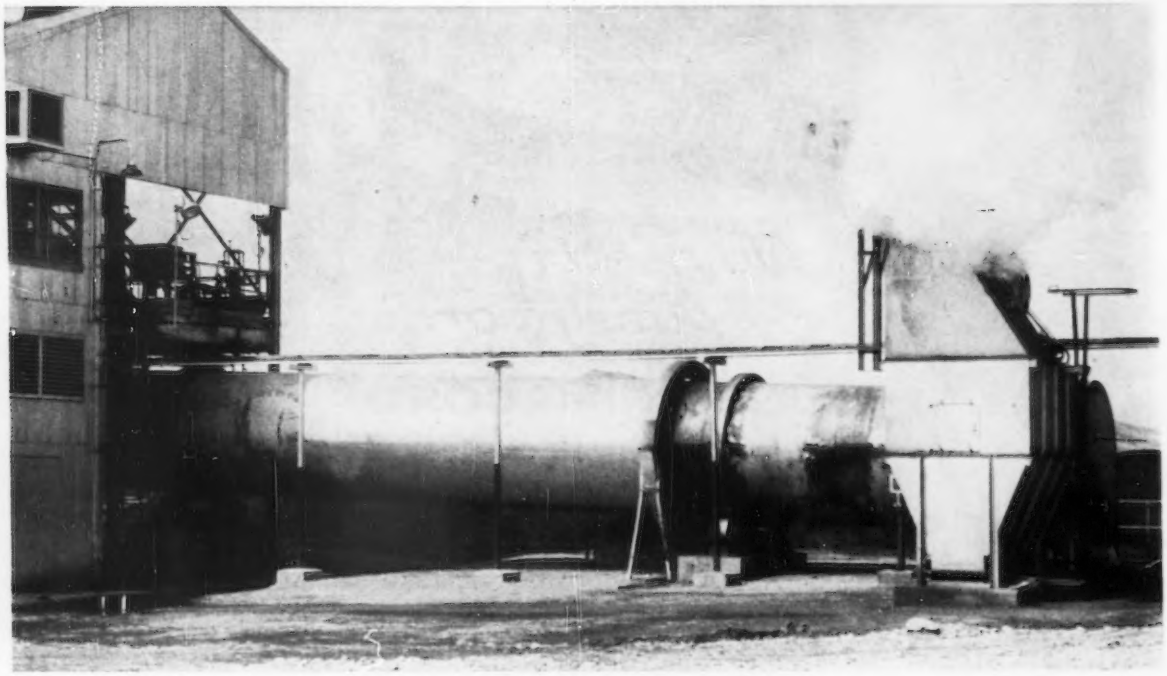
HELPING OTHERS PRODUCE A BETTER PRODUCT...

STANDARD HERSEY DRYERS



American Gilsonite's STANDARD cooler in operation at Grand Junction, Colorado.

GILSONITE TO GASOLINE... STANDARD STEEL SUPPLIES COKE COOLER FOR FIRST COMMERCIAL PLANT!

Standard Steel Corporation designed and built the rotary coke cooler now in operation at American Gilsonite's new refinery at Grand Junction, Colorado. This refinery, the first of its kind in the country to convert gilsonite into gasoline on a full scale commercial basis, uses an 8 ft. by 80 ft. coke cooler in the process. It's another cooler *Job-Engineered* by Standard Steel Corporation! A specially designed "floating inner jacket" protects the outer shell... and a water cooled feed and chute pre-cools the coke. Here is another fine name added to the long list of prominent, satisfied users of STANDARD STEEL rotary processing equipment.

Designers and Manufacturers of

ROTARY DRYERS
KILNS—COOLERS
CALCINERS
HEAT EXCHANGERS
... AND OTHER PROCESS EQUIPMENT

IF YOU HAVE A PROCESSING PROBLEM!

STANDARD STEEL welcomes the opportunity to discuss with you any problems you may have in drying, cooling or calcining. Our laboratory testing equipment determines beforehand the best equipment for your problem.

STANDARD STEEL CORPORATION

General Offices & Plant, 5060 Boyle Avenue, Los Angeles 58, California

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(Division of Standard Steel Corporation)

ROTARY DRYERS • KILNS • COOLERS • ASPHALT PLANTS

FREE WIRE ROPE RECOMMENDATIONS TO HELP YOU SAVE MONEY

Prepared by Experts, Booklets Give Specialized Wire Rope Uses in 5 Fields

What do you do when you have to decide what rope to order? Do you rely on your memory or look up the last order?

Here's an easy way to get the right answers *fast*. Refer to the Wire Rope Recommendation Booklet prepared by HAZARD engineers as a result of years of work in the field with every kind of machine that calls for wire rope. There's a different booklet for each of five basic industries—general contracting, industrial, mining, logging and marine. We'd like you to have these booklets for quick reference because they'll save you time and money by giving you the right answer of the right rope to use for any job in your field.

Written in clear, non-technical language, these new booklets are from 8 to 24 pages long. In addition to detailed wire rope recommendations for your own field, there is a page of LAY-SET wire rope characteristics which explains fully the basic terms of diameter, construction, lay, grade and core . . . all necessary in understanding wire rope nomenclature. Many action pictures of equipment at work also help to show the reader how recommended wire ropes are actually used on the job.

Send today for copies of any or all of the 5 free Wire Rope Recommendation Booklets. Simply check the booklets you would like to receive, in the coupon provided.

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American Chain & Cable Company, Inc.
Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Odessa, Tex., Philadelphia, Pittsburgh, Portland, Ore., San Francisco, Bridgeport, Conn.

HAZARD WIRE ROPE DIVISION, Wilkes-Barre, Pennsylvania

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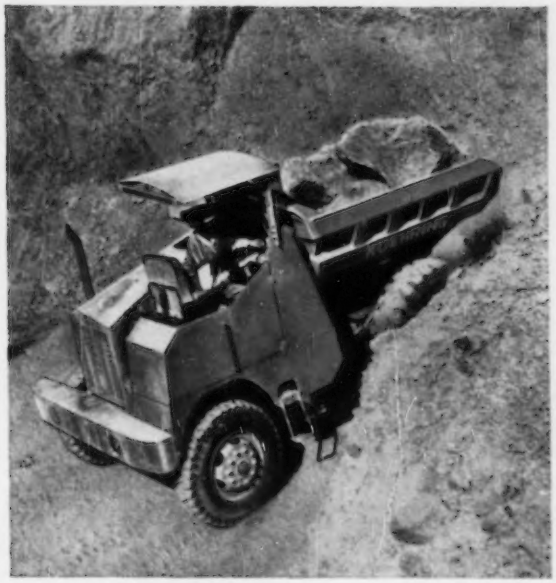
MINING WITH DUMPTORS

...in open pits...and underground

Follow Koehring Dumptor through a typical load-haul-dump cycle, and you'll quickly see why it has gained such wide acceptance on all kinds of mine hauling, stockpiling, feeding hoppers, etc. First, notice how it saves time at the loader (above). Wide-flared 6-yard body, with low height, provides a big square target — *64 square feet, to be exact* — for loading over either side or end by shovel, dragline or front-end loader. On the haul, Dumptor travels at the same speeds in either direction. *There's no need to turn* — an important advantage when working along narrow ledges, overhead trestles, tunnels, etc. It accelerates fast, climbs 24% ramps or grades with capacity load. That's because there's better than 6 H.P. of *"go"* for every ton of loaded weight. At the dump area, *gravity* tilts the body, dumps the load *in one second*. There's no 15 to 25-second wait for slow-acting mechanical body-hoist — and no expensive hoist maintenance, because *gravity-dump* never balks, never wears out. You get all these advantages *and more* when you haul with heavy-duty Dumptors. See your local Koehring distributor about a demonstration, or write to us for the latest Dumptor® catalog.



Up-grade all the way — Near Mexico, D.F., 3 Dumptors haul rock and sand 600 feet up-hill from mine to hopper. In spite of steep, winding road, and normal loading delays, each Dumptor averages 150 loads per 12-hour day. These heavy-duty, 6-yard haulers, with their high ratio of H.P.-to-weight, can climb mine grades as steep as 24% fully loaded.

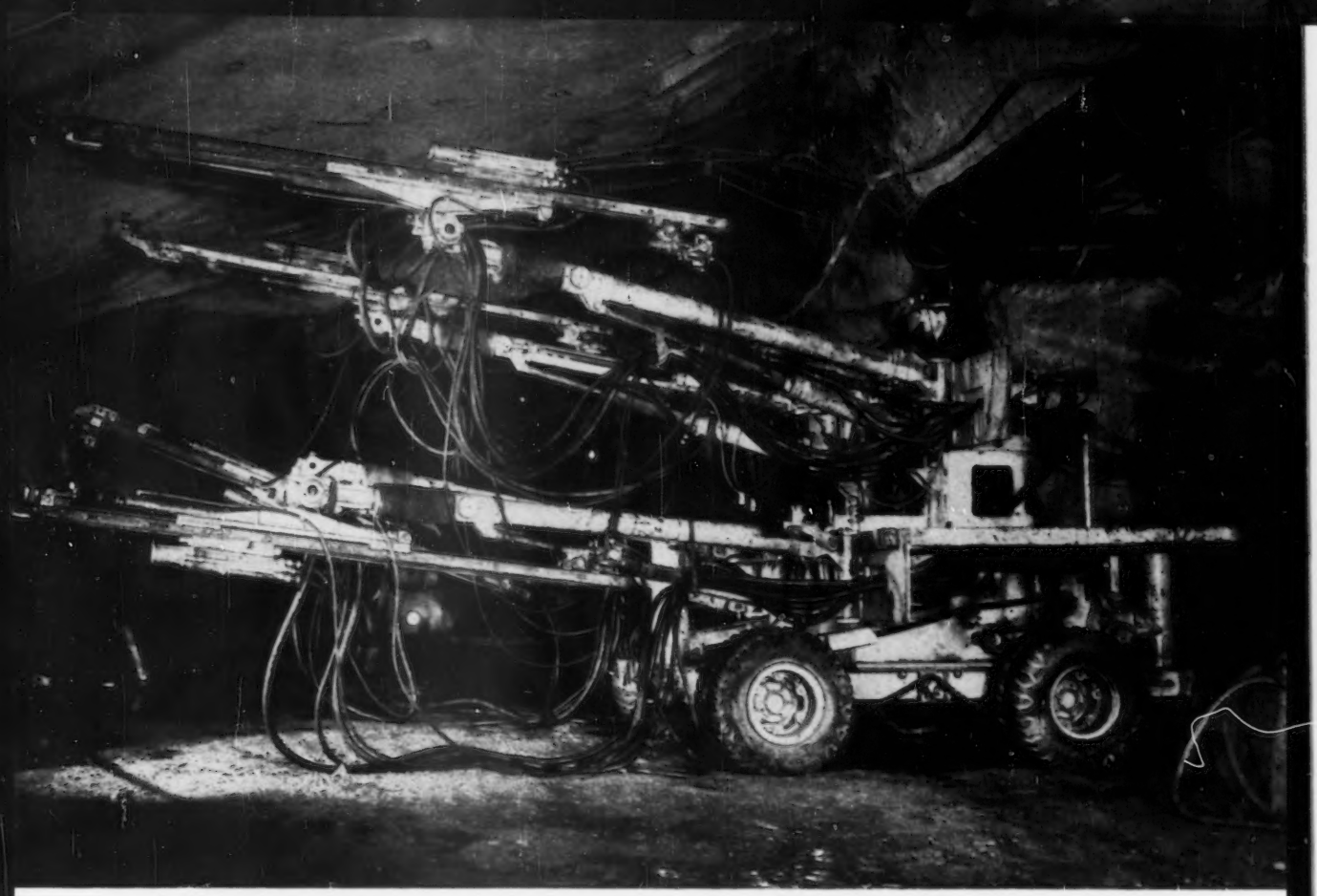
Dump time: 1 second — At hillside hopper, Dumptor drives up, body forward. Operator trips a body-release lever, and *gravity* tilts the body — dumps the load instantly. Free-swinging kick-out pan breaks load suction for fast, clean dump when hauling wet, sticky materials — bolts down to floor of dump body when handling heavy boulders like this.

Shuttles underground — There's no room to turn in this mine tunnel, and no need to turn. Koehring Dumptor drives up, gets its load, then shuttles back out of tunnel at the same speed as it entered. It operates with equal ease and speed in either direction — is as efficient underground as it is on inclined ramps, overhead trestles, or hauling on the surface.

An inside job — To save rehandling of materials, 2 Dumptors haul clay from pit to processing plant, dump directly into hoppers inside the plant. Convenient end-dump, and no-turn shuttle hauling are especially practical on operations like this, eliminate turning and spotting in crowded work-areas. Handy, too, for stockpiling, and loading rail cars.

KOEHRING DIVISION OF KOEHRING COMPANY • Milwaukee 16, Wis.

K745



JOY DRILLMOBILES SPEED DRILLING IN CANADIAN URANIUM OPERATIONS

In the Blind River area the emphasis is on *speed.* And for fast, mechanized drilling Joy Drillmobiles are the choice. Mounting two, three or four powerful 3½ drifters on Joy Hydro Drill Jibs, these Drillmobiles are mobile marvels underground. Self-propelled with tractor-type steering, the Drillmobiles get into position fast—reach the tightest drilling locations. At the face, hydraulically operated Hydro Drill Jibs spot the drills quickly, smoothly, accurately. Double-acting power-lift and power-swing cylinders anchor the drills solidly—prevent creeping or settling.

With the unequalled flexibility provided by extensible Jibs, the Drillmobiles can drill out rooms as wide as 32′ from a single setup—reach up to drill horizontal holes at a height of 18′. The powerful, high speed Joy drifters quickly drill deep hole rounds. Joy long chain feeds and tungsten carbide Rock Drill Bits practically eliminate steel changes. Automatic operation and remote control greatly reduce operator fatigue and increase safety . . . keep production up throughout the shift.

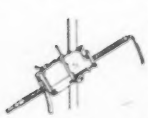
These are the reasons why Joy Drillmobiles are specified for high tonnage operations at Blind River. Talk to a Joy engineer about the Drillmobile for your operation. There are seven models to choose from.

Write to ***Joy Manufacturing Company, Oliver Building Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

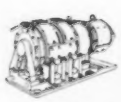
WBW M6720-188

JOY . . . EQUIPMENT FOR MINING . . . FOR ALL INDUSTRY

Write for free bulletin 188-4



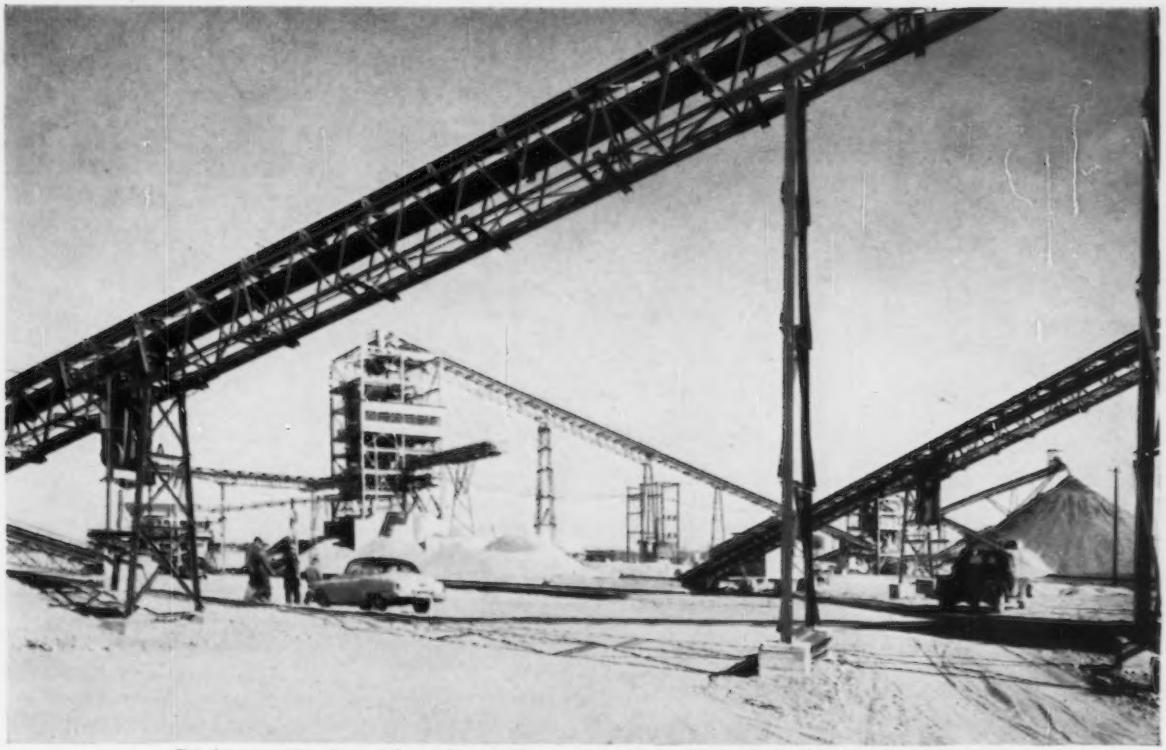
Core Drills



Slushers

Rock Bits

Trackless Equipment



This shows a portion of one of the year's outstanding conveyor jobs . . . Consumer's Company, Crystal Lake, Illinois.

It's not true that Barber-Greene invented the belt conveyor

. . . but it is true that Barber-Greene introduced the greatest advance in belt conveyors since their invention —*standardization.*

Before Barber-Greene entered the field in 1916, belt conveyors were economical on paper—costly to build. Most installations were tailor-made, involving slow single-unit production . . . expensive field engineering . . . complicated assembly.

Then Barber-Greene developed a unique system of standardized conveyor components that quickly outdated ordinary methods of erection, operation and maintenance. Soon standardized conveyors were known for:

Faster delivery. Packaged units come from dealer stock or are immediately available from the factory.

Low-cost erection. Conveyors get into operation sooner with big savings in engineering costs.

Unmatched flexibility. Interchangeable parts simplify lengthening or shortening of conveyors to meet changing needs.

Today, standardized components are practical for installations of nearly every length, width and capacity. Wherever used, they give a new meaning to conveyor economy, utility and flexibility.

Drives, take-ups and similar units are completely assembled, aligned and adjusted by experts at the factory to assure trouble-free operation.

Write for literature or contact our conveyor division for details on your conveyor problem. 56-39RE

Barber-Greene BG

AURORA, ILLINOIS, U.S.A.

CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

A MAJOR ADVANCE!

A TRULY PORTABLE MAGNETOMETER

FOR GEOLOGICAL AND GEOPHYSICAL EXPLORATION

THE VARIAN M-49

operating on revolutionary nuclear-free-precession principle **detects variations in the earth's magnetic field associated with magnetic ore bodies, subsurface faults and structural anomalies. Sensitivity of plus or minus 10 gammas is more than ample for the purpose. An extremely short (6 second) automatic reading interval permits rapid reconnaissance of large areas. Weight is only 16 pounds.**

The Varian M-49 needs no leveling, calibration or orientation in azimuth. Its readings are precise even when the magnetometer is in motion — carried by a man on foot — mounted on horseback — or embarked in a boat. The sensing head is connected by cable and can be separated from the instrument body by several hundred feet—suspended by balloon—lowered over vertical cliffs.

To achieve these unique properties, Varian uses the proton free-precession principle which relies on an immutable nuclear constant (of the hydrogen atom). Other Varian magnetometers operating on this same principle are in use in magnetic observatories, airborne surveys, underwater surveys and in space vehicles.

FEATURES...

- Range 19,000 to 100,000 gammas.
- Direct reading meter in gammas; sensitivity of ± 10 gammas; no calibration required.
- Weighs only 16 pounds; all-transistor design; compact and rugged.
- Reading interval manually controlled or six-second automatic; usable stationary or in motion.
- Cable-connected sensing head separable by several hundred feet for multilevel surveys.
- Polarizing cells rechargeable by simple connection to automobile battery.

Write today for a full explanation of the Varian Magnetometer's principles, applications and equipment details.

VARIAN associates

INSTRUMENT DIVISION

611 Hansen Way, Palo Alto 29, California

It pays to take a "SECOND LOOK" before you buy a straight bulldozer

Compare the "Big 4" for yourself!

Feature	Case TerraTrac "800"	Mfr. "A"	Mfr. "B"	Mfr. "C"
Blade Width	8'	8'2½"	8'	7'11⅞"
Power-Tilt Blade..	YES	NONE	NONE	NONE
Engine HP (net)..	72 (80 Gross)	63	66.5	66
Torque Converter	YES	NONE	NONE	NONE
Max. lbs. push or pull	20,000*	10,700	15,485	12,600
Forward Speeds, MPH	(4) 0 to 6.0	(4) 1.5 to 6.1	(4) 1.5 to 5.5	(4) 1.7 to 5.9
Reverse Speeds, MPH	(4) 0 to 7.0	(2) 1.7 to 2.6	(2) 2.0 to 4.1	(2) 1.9 to 3.9
Power-Shift Transmission ..	YES	NONE	NONE	NONE
Power-Steer	YES	NONE	NONE	NONE
Power-Brakes ...	YES	NONE	NONE	NONE

*Assuming adequate traction

Above information based on latest specification sheets available to us at time of printing

If you need more capacity... investigate the new *100 HP* Case TerraTrac Model 1000. Like the "800", it is available with either POWER-ANGLING, or POWER-TILTING blade, in addition to other features shown above.

CASE

1st in quality for over 100 years

Maybe you didn't realize it... but there's as much difference *performance-wise* between the new Case® TerraTrac® "800" Tilt-Crown dozer — and conventional bulldozers — as there is between a modern *power-operated* automobile and the old-style *"clutch-and-hand-shift"* machines of a few years ago.

Part of this difference you can see "on paper" — in the accompanying chart. But the real difference comes "on the job", where the 800's *exclusive power-tilting blade* — plus greater speed and maneuverability — pay off in more work done per dollar of cost.

Compare the "big four" for yourself. Then mail the handy coupon, so your Case Industrial Dealer can arrange a free demonstration on *your* job — soon!

Clip... mail for more facts

J. I. CASE CO. Dept. A1378, Racine, Wis., U.S.A.

Send literature on Case TerraTrac Dozers

☐ Model 800 ☐ Model 1000 ☐ Power-Tilt ☐ Power-Angling

Name ..... Position .....

Company .....

Address .....

City ..... State .....

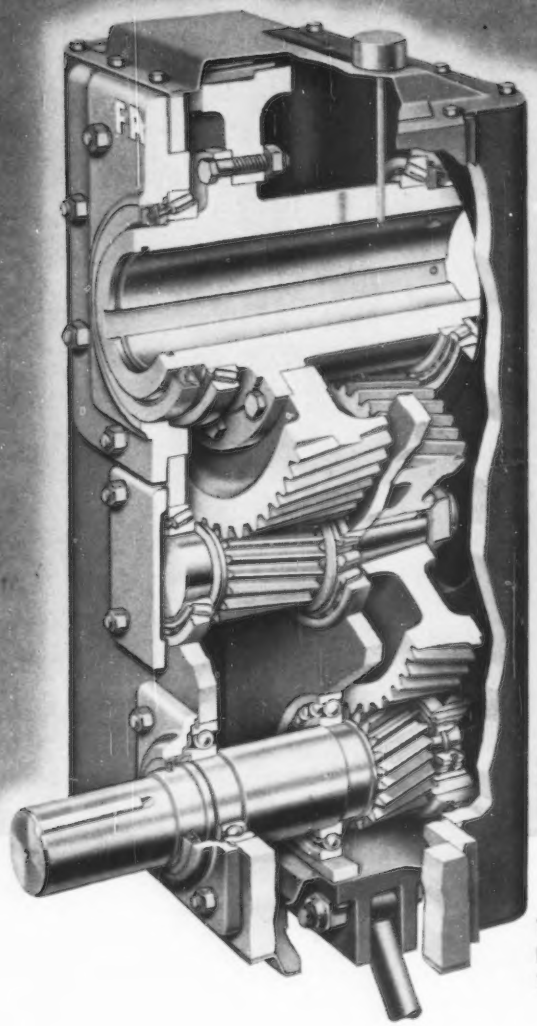
CT-D-55

INDUSTRIAL WHEEL AND CRAWLER TRACTORS • LOADERS • DOZERS • BACKHOES • ENGINES

New...LARGER...ALL-STEEL!

–the FALK 315J Shaft Mounted Drive

- **for higher horsepower**
- **for lower output speeds**



THE NEW 315J...
FROM 2 HP AT 5 RPM
TO 50 HP AT 359 RPM

Check These Features

New — 3-wall, one-piece housing provides double the ability of cast iron to withstand external impact or shock loads.

New — ratio range—5:1, 14:1 or 25:1. Higher ratio range makes possible lower output speeds...smaller sheaves...standard, rather than slow-speed, motor.

New — ease of maintenance. All revolving elements can be easily replaced in the field, on the jobsite! Inspection covers permit quick inspection of gears and bearings. Dipstick provides quick check on lubricant.

New — longer center distance between shafts allows use of larger sheave on input shaft. Unit may be mounted with input shaft next to driven machine, and with motor mounted directly under driven shaft.

PROMPT DELIVERY

Standard units are available for off-the-shelf shipment from factory, warehouse or distributor stock.

LET US HELP YOU

Your Falk Representative or Authorized Falk Distributor will gladly review your applications and offer suggested selections—without obligation.

Write for Bulletin 7100

The new Falk 315J also gives you these famous Falk advantages—

- Falk extra-depth, extra-capacity gear teeth—plus the extra efficiency (98½% per gear mesh) of helical gears for maximum power utilization.
- Through-hollow shaft design for easy installation, with internal groove to permit use of bearing puller when dismounting unit. Hollow shaft also permits use of unit on through-shaft applications.
- Tie rod fastened to steel housing by steel bracket with bolt in double shear. Shock load on tie rod will not damage housing.

THE FALK CORPORATION, MILWAUKEE 1, WISCONSIN

Representatives and Distributors in Most Principal Cities

Manufacturers of Quality Gear Drives and Flexible Shaft Couplings

FALK

...a good name in industry

WESTERN

every metallurgical chemical you require ...

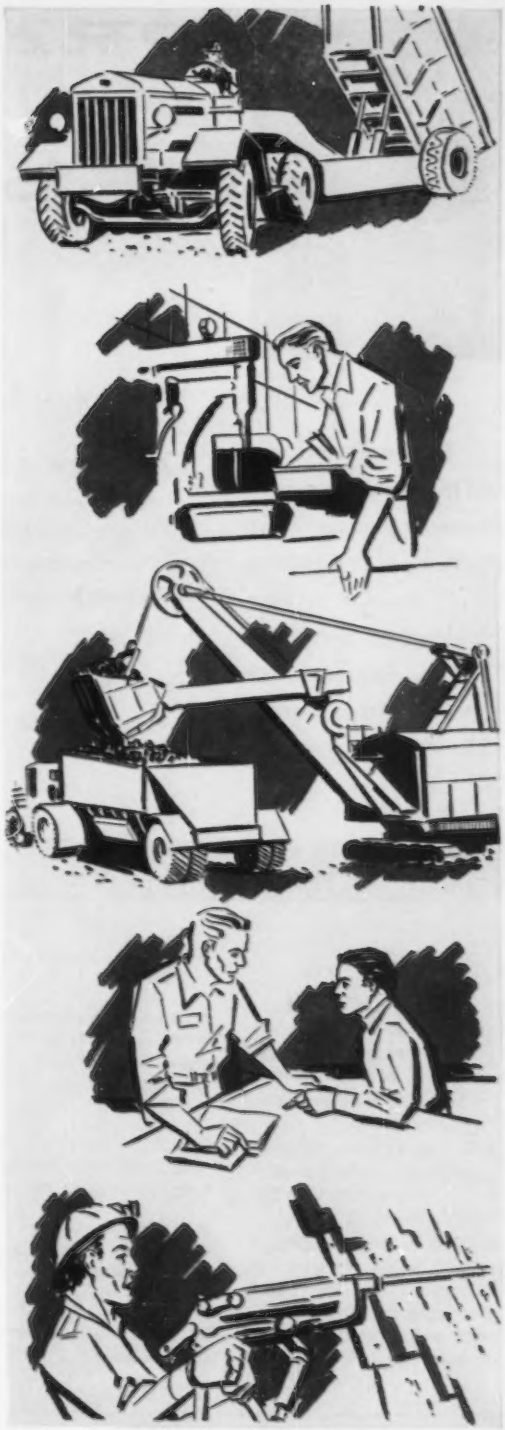
plus comprehensive technical service ...

in one complete package!

Cyanamid dependably supplies the widest selection of flotation and cyanidation reagents available from a single source!

You can safely minimize inventories, simplify purchasing with consolidated orders and frequently lower shipping costs.

And when you deal with Cyanamid, you can also get valuable in-the-mill help from our field engineers . . . experienced men who are kept currently informed on ore-dressing developments throughout the mining world.



AEROFLOAT® Promoters

AEROFLOC® Reagents

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Sodium Cyanide

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CYQUEST* 40 Sequestering Agent

AEROSOL® Surface-active Agents

CYANAMID

AMERICAN CYANAMID COMPANY

MINING CHEMICALS DEPARTMENT

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

For The Ultimate in DUST and FUME COLLECTION Be Sure It's...

WESTERN PRECIPITATION *First* in Electrical Precipitators

Plant operators who want the finest equipment available for dust and fume collection will find nothing equal to the long life, high efficiency and low maintenance of *Western Precipitation* Electrical Precipitators.

The reason is simple – No other electrical Precipitator is backed by so many years of leadership in the field – nor incorporates so many outstanding advantages pioneered by the industry's most experienced organization in the development of Cottrell equipment – experience beginning with the world's first commercial Cottrell installation!

This cross-section of a typical Western Precipitation Electrical Precipitator shows a few of the many important details that go into the construction of these units...

CONSTRUCTION FEATURES

▶ Arrangement of curtains (1), baffles and hi-voltage wires (2) assures optimum uniformity of electrical field – therefore maximum collection efficiency.

▶ Baffles (3) insure minimum dust reentrainment and optimum gas distribution.

▶ Curtains and hi-voltage system are engineered for maximum stability, even distribution of rapper impact, and unequalled ease of installation.

▶ No moving parts in the gas stream.

▶ Supports (4) for hi-voltage system are specially designed to resist side thrusts, and require minimum maintenance.

▶ Internal stiffeners permit clean, smooth external surfaces for easy insulation (5).

▶ Air-swept insulator compartments (6) insure long life, minimum maintenance.

▶ Unobstructed free-flowing hoppers (7) permit complete dust evacuation.

ADVANCED RAPPER DESIGN

▶ Frequency and intensity of rapping is variable over wide ranges to eliminate puffing and meet individual operating requirements.

▶ All rappers (8) are external for easy adjustment and maintenance.

▶ Flexible mounting – either side or top.

SAFETY ENGINEERED

▶ Hi-voltage insulators (9) are protected by separate compartments with individual access (10).

▶ Quick-opening access (11) doors are positive-sealing.

▶ Complete interlock system available at minimum cost.

"TRANSISTOMATIC" PRECIPITATOR CONTROL

▶ No tubes, no relays, no moving parts – *carries lifetime guarantee!*

▶ *Infinitely* variable precipitator voltage to suit operating conditions.

▶ Automatically compensates for line voltage fluctuations.

Before finalizing plans for installing any dust or fume collection equipment, get the full story on the finest collection equipment available – Western Precipitation Cottrells!

WESTERN PRECIPITATION CORPORATION

Engineers and Constructors of Equipment for Collection of Suspended Material from Gases . . . and Equipment for the Process Industries

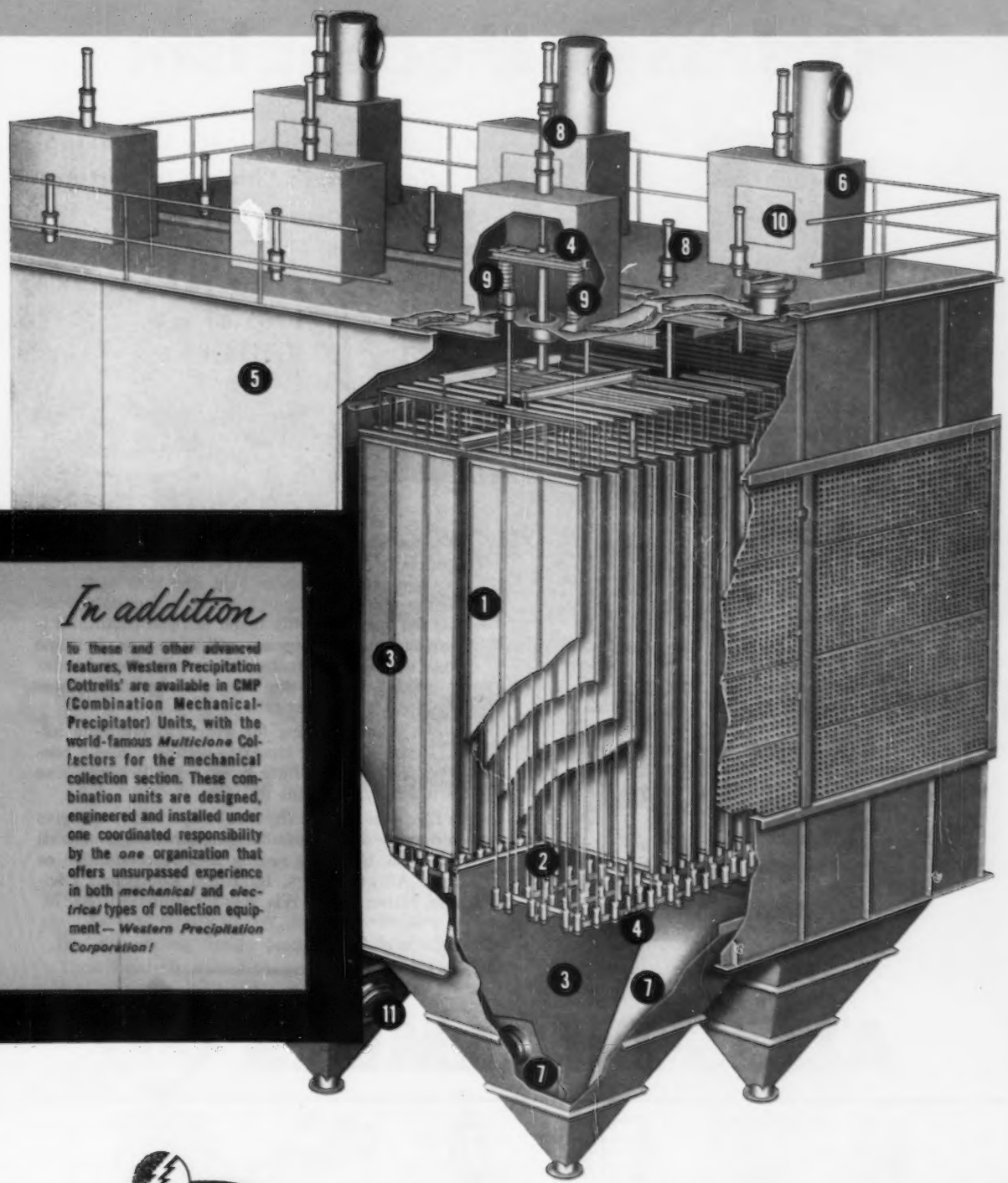
LOS ANGELES 54 • NEW YORK 17 • CHICAGO 2 • PITTSBURGH 22 • ATLANTA 5 • SAN FRANCISCO 4

Representatives in all principal cities

Precipitation Company of Canada Ltd., Dominion Square Bldg., Montreal

The only equipment backed by a

Half-Century of Cottrell Experience



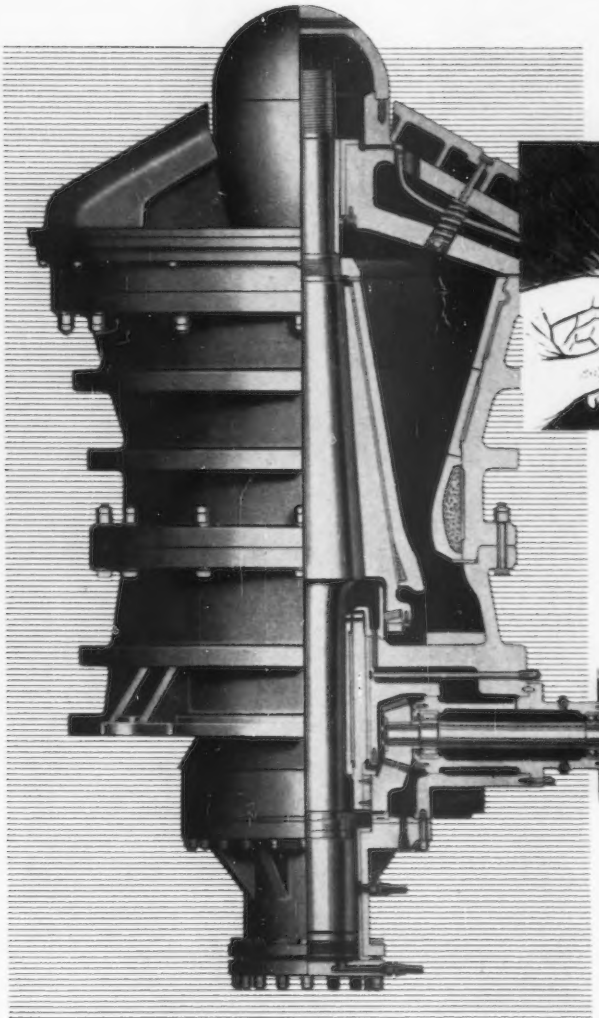
In addition

In these and other advanced features, Western Precipitation Cottrells' are available in CMP (Combination Mechanical-Precipitator) Units, with the world-famous *Multiclone* Collectors for the mechanical collection section. These combination units are designed, engineered and installed under one coordinated responsibility by the *one* organization that offers unsurpassed experience in both *mechanical* and *electrical* types of collection equipment—*Western Precipitation Corporation!*

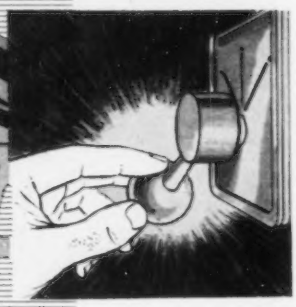
REMEMBER—*in the field of dust collection, nothing equals the long life, low maintenance and high collection efficiency of a Cottrell Electrical Precipitator!*

Superior
GYRATORY
CRUSHER

Hydroset Mechanism

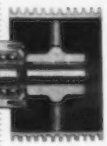


- **Facilitates Emergency Unloading**
- **Allows Rapid Change of Setting**
- **Compensates for Wear**



...at the Flip of a Switch

ONLY an Allis-Chalmers gyratory crusher affords the time-saving convenience of *Hydroset* control. If a *Superior* crusher with built-in *Hydroset* mechanism stops under load, the mainshaft may be lowered at the flip of a switch to facilitate clearing the chamber. Only under extreme conditions is any amount of "digging-out" necessary. In some cases the *Superior* crusher may even be started under load, because the *Hydroset* feature reduces torque requirements.



Compensating for wear and retaining initial setting or changing setting is also a one-man, one-minute operation. Product size always remains uniform.

Hydroset feature (hydraulic operation) can give you many other profit-building advantages. Get all the facts. See your nearby A-C representative or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wis. Ask for Bulletin 07B7870.

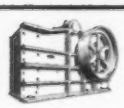
Superior and *Hydroset* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

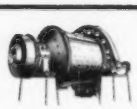
A-5324

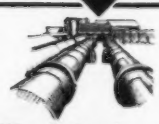
Hammermills

Vibrating Screens


Jaw Crushers

Gyratory Crushers


Grinding Mills


Kilns, Coolers, Dryers

This Bucyrus-Erie 150-B is loading iron ore into end-dump trucks in a pit on the Mesabi Range.

CUT THE COSTS YOU CAN CONTROL
with Bucyrus-Erie Electric Shovels

The big capacity, rugged strength and long-life service built into Bucyurs-Erie electric shovels can help hold down digging and loading costs in your pit.

Years of service in every type of mine have proved the outstanding design features of these machines. Their sturdy front-end construction — with exclusive two-section boom, tubular dipper stick and twin dual hoist — provides plenty of strength, reduces deadweight, enables these shovels to handle big yardages economically. Bucyrus-Erie-improved Ward Leonard electric control provides fast acceleration and deceleration, extra torque and responsive power to speed work cycles. Strength and durability throughout assures efficient performance for profitable operations over a long period.

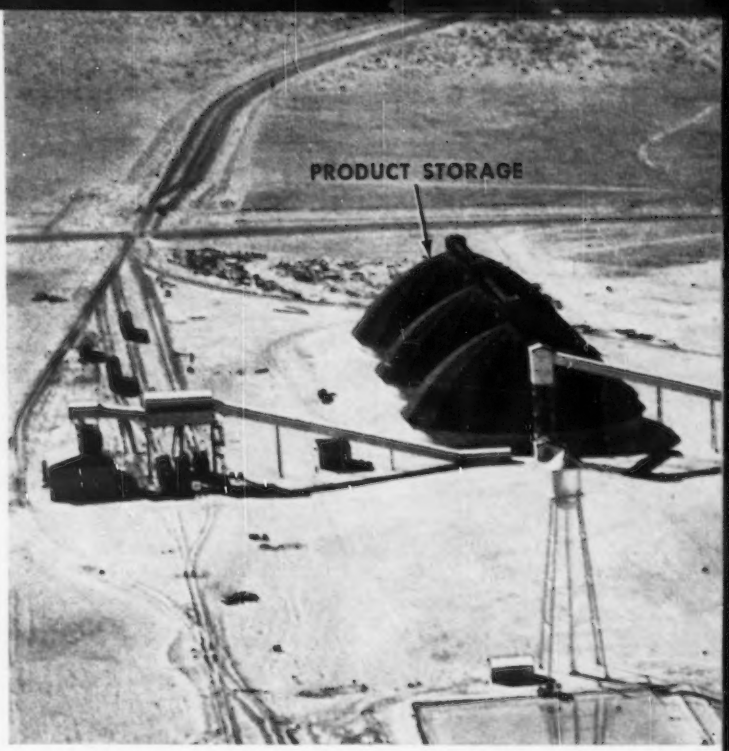
Let us give you complete information on these and other features of Bucyrus-Erie electric shovels and show you how they can help you control costs in your pit.

147L57C

A Familiar Sign... BUCYRUS ERIE ***...at Scenes of Progress***

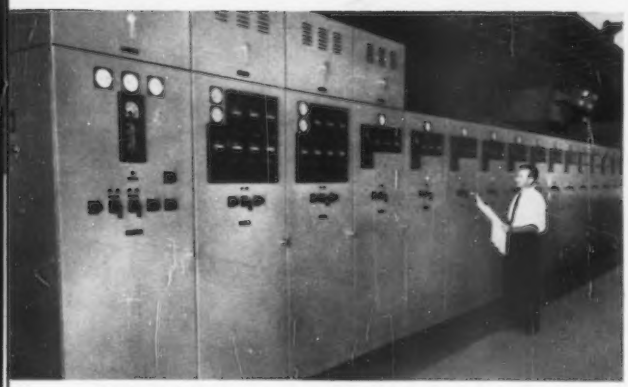
BUCYRUS-ERIE COMPANY • SOUTH MILWAUKEE, WISCONSIN

ENGINEERING REPORTS:

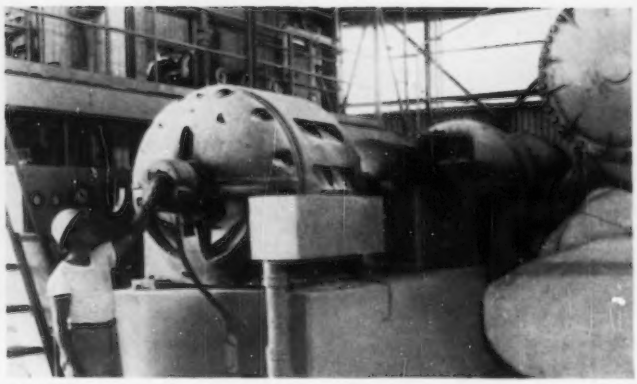


Highly electrified

PLANNING electrical system are (l. to r.) G. R. Yelderman of G.E., D. A. Haley, National Potash electrical engineer, R. W. Jenkins, former underground supt.

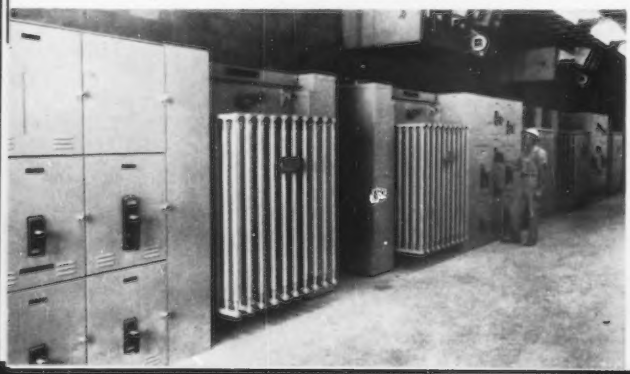


ENTERING bank of space-saving G-E metal-clad switchgear in substation #1 is incoming 12,470-v power. This economical high voltage is distributed to entire mine and refinery.

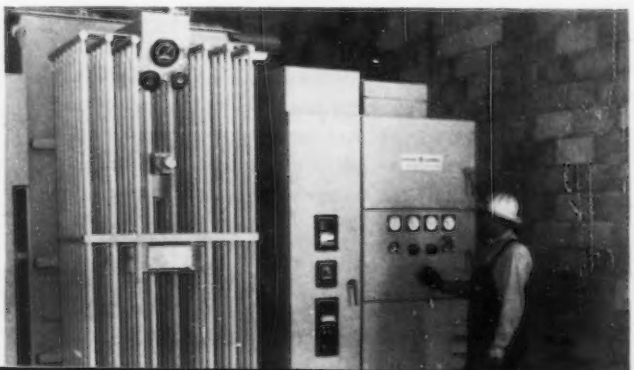


DRIVING refrigeration compressors, utilized in the refining process, is a dependable G-E 1250-hp 4160-v synchronous motor, carefully protected by electrical safety devices.

SUPPLYING full-voltage power for 174 refinery motors (¼ to 200 hp) are three G-E load-center unit substations in refinery. All substations are rated 12,470-480Y/277 volts.



SERVING as starter, protection for 1250-hp motor driving refinery refrigeration system is high-voltage Limitamp* control (r.) fed by 12,470/4160-v G-E medium transformer (l.).



BUCYRUS-ERIE COMPANY, SOUTH MILWAUKEE, WISCONSIN

PRODUCTION FLOW at new mine is via conveyor from (r. to l.) initial ore storage to crushing, refining, and product storage.

National Potash mine producing 3000 tons/day

MIXING of crude ore with saturated brine and reagents, prior to flotation, is powered by corrosion-resistant, cast-iron **TEFC**, Tri-Clad* 55 motors.

CONTROLLING low-voltage refinery motors is G-E motor-control center. Grouping of motor controls saves space, eases installation, maintenance.

General Electric services, equipment help provide maximum shut-down protection, lower power-distribution costs

Newest mine in the vast potash-rich area of southeast New Mexico is the multi-million dollar project of National Potash Company. Now producing at a rate of 3000 tpd, its smooth flow of production is aided by modern, G-E system-engineered electrical equipment. General Electric engineers and The Stearns-Roger Mfg. Co. of Denver, engineers and constructors of the plant, worked with National Potash to design and install a system which incorporates safe, flexible, economical distribution and utilization of electric power.

THIS INTEGRATED SYSTEM features the use of the primary 12 kv as an economical distribution voltage as well—even carries it 1700 feet underground. Major plant electrical equipment receives better grounding protection through a plant-wide grounding loop terminating in a 300-ft water well. Electrical interlocking for the entire plant motor system provides equipment protection by shutting down all necessary equipment in the event of outages at any point.

YOU CAN BENEFIT, too, from the help of G-E engineering services. Before you expand or modernize, contact your nearest General Electric Apparatus Sales Office early in your system planning. General Electric Co., Schenectady 5, N. Y.

*Reg. trademark of General Electric Company. 660-38

Engineered Electrical Systems for the Mining Industry

GENERAL ELECTRIC

Your "Cost" Dollars Come Back QUICKER...

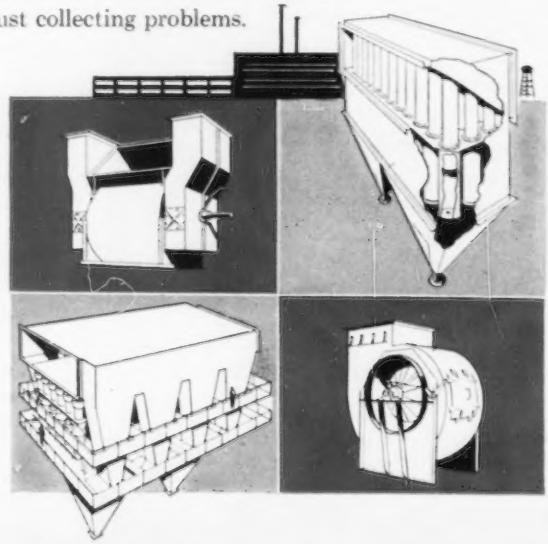
with WHIRLEX dust collecting equipment!

If you are concerned with nuisance elimination . . . or with the recovery of process material . . . WHIRLEX can help you. Our research laboratory, engineering and manufacturing facilities are *totally set up* and especially experienced to provide "dollar-saving" solutions to the most perplexing dust collecting problems.

Low original cost *plus* continuous, efficient operation and low maintenance of WHIRLEX equipment assure quickest return of cost dollars!

For a completely integrated and co-ordinated installation, the following shop-assembled equipment is available:

WHIRLEX Type CTF Mechanical Gas Centrifuge Collectors
WHIRLEX Type MTSA 9CYT Multiple Cyclone Collectors
WHIRLEX Induced Draft Fans · WHIRLEX Forced Draft Fans
Special Duct Work · Self-Supporting Stacks
Support Structures



FLY ASH WHIRLEX ARRESTOR

Write today for complete engineering data...

THE FLY ASH ARRESTOR CORPORATION

283 North First Street — Birmingham, Alabama

Major copper mine in Arizona

helps boost production with 2 heavy-duty graders

Building railroad bed, Adams 660 works dumped waste material to edge of bank for casting overside with bulldozer blade.

Said one grader operator, "The Adams is much faster . . . will do twice as much work. Controls are easier, blade visibility better."

At a large open-pit mine in Arizona, ore is mined at low levels and hauled by railroad cars . . . at higher levels, overburden is removed by a fleet of 35-ton trucks. To help these haulers travel at safe, profitable speeds, and to speed road and rail-spur construction — the mine uses two 150 hp Adams* 660 graders.

Patrols roads 24 hrs. a day, 6 days per week

One of the heavy-duty "660" LeTourneau-Westinghouse units is used primarily for maintaining many miles of haul roads. This fast-moving grader patrols these busy mine roads 24 hours a day, 6 days a week. It goes wherever needed . . . to fill ruts, level washboard, clear debris dropped by overloaded haulers and improve drainage.

For working along steep drop-offs, the Adams' standard blade extends a full 7½ ft. beyond wheel line, to give operator safe working margin. Extra-safe dual-braking system stops transmission as well as tandem drive-wheels for sure, safe stops and minimum brake wear.

Helps build new roads, RR grades

The second "660" grader — equipped with bulldozer blade — is used on new construction work and for maintaining waste dump. When constructing new roads or railroad beds, the "660" handles all the blade work.

Works any kind of material

Wide range of speeds give Adams advantage for working efficiently in any kind of material. All 80 to 150 hp Adams graders have an 8 forward and 4 reverse speed transmission. In addition, optional 3-speed "creeper" gears (0.23 to 1.82 mph) may be added. These low, full-power speeds move heavier loads, handle rocky material with greater speed and safety, insure more accurate blade control for fine finishing around forms or obstructions.

Adams' largest grader — the powerful 190 hp POWER-*Flow* 660, with torque converter — gives you an infinite number of speeds forward to 27.4 mph . . . reverse to 24.4 mph. Adams' smallest, the 60 hp "220", has 5 speeds forward to 18.3 mph — best in its class.

See Adams in action

Why not see how you, too, can step up mine and quarry production, cut operating costs — with heavy-duty Adams graders? There are 6 models: 190, 150, 123, 115, 80, 60 hp. Choice of GM or Cummins engines on 5 larger models. Call or write for a demonstration at your pit.

With dozer blade, "660" maintains waste dump. Over 72% of the total amount of material mined at this copper mine is waste.

Powerful "660" helps build exploration roads and RR road beds fast and easy. Commenting on the Adams grader, the second operator said, "I like the power and weight of the '660'. Also, the big 14-ft. moldboard and wide choice of speeds."

*Trademark G-1483-M-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

No. 1 in a series

Right off the Wire

An all-electronic telephone exchange (said to be the first for commercial use) has no moving parts, is noiseless and can be used in explosive atmospheres. It includes a "memory" which will hold an incoming call.

Wire can be strung beside a railroad track by a new travelling crane at the rate of 60,000 feet per hour.

Simplex recently completed one of the largest and heaviest shipments of cable ever transported on one reel — nearly two miles of ANHYDREX XX insulated submarine cable weighing 60 tons.

A new rubber-like material is porous, but will contain liquids.

Boron, lithium, hydrogen peroxide and fluorine compounds are to be the fuels of a new bomber reported to be in the design stage.

Smog-causing chemicals from automobile exhausts can be eliminated by a chemical catalyst developed by an automobile manufacturer.

Improvements in the explosive rivet have made it noiseless.

Only the touch of a hand is needed to light a new lamp. The electricity in the hand does the work.

Thorium is about three times as plentiful as uranium. A new process for the production of reactor-grade thorium should lead to a reduction in the cost of atomic fuel.

A high-output ultraviolet lamp, for heating and air-conditioning ducts, is claimed to be 1,000 times more effective in killing viruses and bacteria than an equal amount of radiation from the sun.

The world's largest solar furnace is to be completed in 1959. It will produce temperatures as high as 8,000°F, which is about 70% of the temperature of the sun's surface.

An ultra-hard glass has been developed that retains its hardness up to 1508°F.

The cost of converting sea water to fresh water has been reduced from $1.50 to 60 cents per thousand gallons.

"Talk-back TV", a new advance in educational television, enables a pupil to ask questions of a teacher who is broadcasting from a distant room.

Scientists have been able to produce shock waves with speeds of more than 100,000 mph (above Mach 150) involving temperatures higher than 100,000°F.

Some 1958 automobiles are using aluminum instead of copper in battery cables.

The first deep sea telephone cables to utilize the revolutionary new Bell Laboratory vacuum tube repeaters were manufactured by Simplex. Minimum tube life is expected to be 20 years.

Danish trawlers are using nylon propellers. The four-foot, three-bladed size weighs only seventeen pounds and they reduce vibration, resist impact damage and corrosion.

A cell that generates electricity by the chemical action of oxygen and hydrogen has been announced. It avoids some of the disadvantages of both dry cells and storage batteries.

An airplane has been built which can change its shape while in flight for the purpose of testing aerodynamic configurations.

C-L-X (Sealex) is the name of a new, completely sealed, corrugated metallic cable sheath manufactured by Simplex. It is pliable, moistureproof, and permits cable engineers to select the most economical cable cores, while assuring the greatest mechanical protection available.

Observations of the aurora during the Geophysical Year show that it occurs simultaneously at both the North and South Poles. This definitely identifies it with the earth's magnetic field.

A miniature battery about the size of a paper clip is said to deliver a steady flow of current for 176,000 hours.

Shirtsleeve Service

Simplex recently completed an order for 4600 ft. of Anhydrex XX Parkway Cable. The Simplex man was on the spot to help with installation, which happened to be on a 9,500 ft. mountain in rough terrain. He helped design a reel mounting bracket (for holding up to 7200 lbs.) for the front of the tractor used for laying. He supervised the laying of two lengths 2200 feet long.

This case typifies the kind of cooperation that Simplex offers in order to assure correct installation and satisfactory service.

SIMPLEX WIRE & CABLE CO.
Cambridge, Massachusetts and
Newington, New Hampshire

Simplex

Highest quality cables for: Mining
Power & Lighting • Construction
Transportation • Communications
Signalling

See us at Booth 1124 Plant Maintenance & Engineering Show, Chicago

How self-powered scrapers help cut mine operating costs

Tournapulls may be self-loaded, push-loaded, or shovel-loaded. The 9-yard "D" shown here hauls at speeds to 29.5 mph, unloads in seconds, makes complete turn in 26 feet. Simple electric controls and big 4-wheel air brakes permit rig to work safely at high speeds in tightly restricted quarters.

Read the following list of mine-scraper applications . . . analyze these scraper economies for your open pits:

1 In auxiliary stripping, where overburden is so thick that the wash or earth must be removed to allow boom-type equipment to work within its economical limits.

2 Where spoil room for boom-tool operations is inadequate; where outcrop is bothered by property lines, highways, railroads, pipe lines, power lines and undivertable streams.

Rigs make 180° turns, in less than machine's length, operate in tight quarters as shown above. Tournapulls keep working in tough going when other self-powered scrapers bog down. When one wheel slips, exclusive power-transfer differential automatically transfers power to wheel on firmest footing. Positive geared steer on kingpin pivots prime-mover from side to side, "walking" drive wheels to fresh footing.

3 Widening a bench at the side of the pit to provide greater casting area for shovel or dragline.

4 Stripping wet top-layers of earth, which might slough and cause slides into a shovel cut.

5 Cutting the initial box-cut, depositing the spoil out-of-the-way of later dragline operations.

6 Stripping or mining small or isolated veins that do not warrant the expense of moving large excavating equipment to the site.

7 Stripping hillside and hilltop operations...self-powered scrapers particularly adapted for this type of work.

8 Cutting new beds for temporary or permanent stream diversions; building dams and settling ponds.

9 Building grades for railroads and for truck haul-roads.

10 Construction and maintenance of ditch and drainage systems.

11 Grading around mine buildings and mine location housing.

12 Land-fill disposal of refuse.

13 Stockpiling of coal . . . spreads in even layers, compacts while hauling.

14 Supplementary hauling of ore, coal, or overburden...open-top scraper can be shovel-loaded and used as a truck-type hauler.

15 Mining lean ore, previously abandoned, in widely scattered or isolated areas.

16 Stripping overburden where level piling of spoil is required.

17 Stripping shallow overburden which does not justify expense of installing and operating major excavating equipment.

18 Leveling spoil piles for drainage, reforestation, farming, etc.

19 Removing and replacing top-soil for reclamation purposes.

If you have any of the above dirt-moving problems . . . write us or check with your nearest LeTourneau-Westinghouse Distributor. We'll be glad to have our experienced field engineers analyze your operation and propose suitable procedure and equipment for most economical handling. Our rubber-tired prime-mover scraper combinations are available in three sizes: "D" . . . 138 hp . . . 9 yards heaped capacity; "C" . . . 210 hp . . . 18 yards heaped capacity; BIG "B" . . . 293 hp . . . 27 yards heaped.

Tournapull—Trademark Reg. U.S. Pat. Off. P-1508-M-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

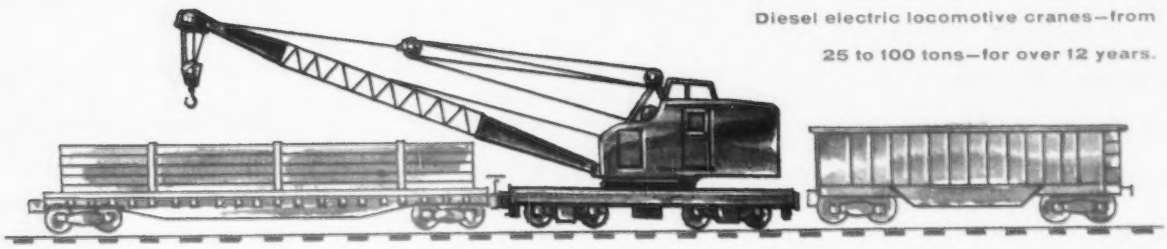
STAY ON THE RIGHT TRACK

WITH

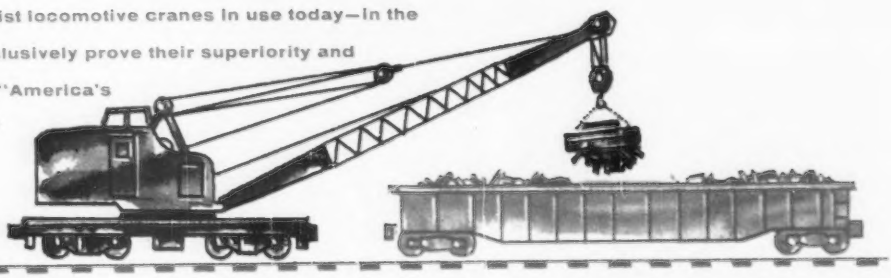
BROWNHOIST

DIESEL ELECTRIC LOCOMOTIVE CRANES

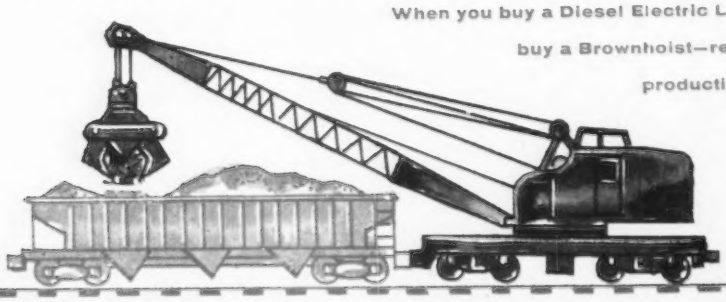
Industrial Brownhoist Corporation has been engineering and building locomotive cranes since 1873—Diesel electric locomotive cranes—from 25 to 100 tons—for over 12 years.



The thousands of Brownhoist locomotive cranes in use today—in the largest corporations—conclusively prove their superiority and their earned reputation as "America's No. 1 Locomotive Cranes."



When you buy a Diesel Electric Locomotive Crane, get the best—buy a Brownhoist—records prove their high capacity production and trouble free, economical operation. Write today for new illustrated catalog.



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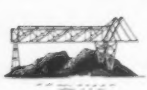
BROWNHOIST

CLAMSHELL BUCKET

250 TON WRECKING CRANE



COAL-ORE BRIDGE

CAR DUMPER

LOCOMOTIVE CRANE

INDUSTRIAL BROWNHOIST CORPORATION, BAY CITY, MICHIGAN • DISTRICT OFFICES: New York, Philadelphia, Cleveland, Chicago, San Francisco, Montreal, Canada • AGENCIES: Detroit, Birmingham, Houston

1. Fingertip electric controls

2. Point-of-action electric motors

3. Hinged body design . . . no frame, no springs

4. Big, multi-disc air brakes on all 4 wheels . . . selective brake control locks front or back wheels, or both

5. Interchangeable tires and wheels, front and rear

6. All-steel body . . . with tri-level bottom

7. Wide bowl, with low rear entry, makes loading easier, faster . . . with less spillage

Cut your pit costs

with high-production Tournapull® Rear-Dump haulers

Capable of high-production in all materials, with a minimum of maintenance, LeTourneau-Westinghouse Tournapulls with Rear-Dumps give you more for your money in productive hours worked . . . more in tons moved . . . at lower cost. Here's why!

Simplified construction

Rear-Dump construction is radically simplified from that of conventional haulers. In place of a foundation frame and body sub-frame, Tournapull prime-mover and trail unit are hitched together by means of a rugged, high, horizontal yoke. Yoke pivots horizontally on kingpin at front . . . then extends back along the sides of the bowl, where it is pivoted vertically just above and ahead of rear wheels.

Heavy-duty bowl resists shock, abrasion, and crushing damage of big chunk-rock dropped by excavator.

Big tires

There are no dual tire or mixed size problems. Big, single, low-pressure tires adequately absorb the shocks of rough off-road travel and shovel loading. Troublesome springs, spring hangers and tie-rods that require frequent maintenance and replacement are eliminated. Long-wearing tires are interchangeable all around . . . one spare serves an entire fleet.

2-wheel prime-mover

Front-wheel drive and kingpin-type steer further simplify Tournapull construction. A multitude of trouble-causing parts are eliminated. No longer must power be carried back to the rear through a long driveshaft . . . with its inherent bearing, universal joint, and lubricating problems. No longer is steering handled by small front wheels subject to misalignment from "bulldozing", as they try to get out of ruts. All compact machinery inside prime-mover case is readily accessible for quick adjustment, easy servicing.

Simple, safe dump action

A touch of electric switch on dashboard instantly activates point-of-action body-hoist motor. Entire dump is under power control — there is no free fall. There's no delay for hydraulic pressure build-up, no shock-loads — as with gravity dumping. You save on maintenance time, too, because there is no hoist maintenance to check . . . only a few places to inspect and lubricate.

For complete information

Find out how these savings can put money in *your* pocket. There are three LeTourneau-Westinghouse Rear-Dump sizes to fit your requirements, with 11, 22 and 35-ton capacities. Write for information.

R-1409-M-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

AN IMPORTANT MESSAGE

TO USERS OF EXPLOSIVES

American Cyanamid Explosives Now Serve You Nationwide and Market-Wide!

In a move to extend and broaden the range of our services to explosives users, American Cyanamid Company has purchased the plants, magazines and sales facilities of Illinois Powder Manufacturing Company.

Because of these expanded facilities, it is now possible for Cyanamid to serve you better...faster...with a wider range of dependable, *quality* explosives, electric blasting caps and blasting accessories.

Our sales representatives will welcome the opportunity to analyze and discuss your blasting problems.

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ROAD CONSTRUCTION

QUARRYING

METAL MINING

COAL

OIL EXPLORATIONS

How 1 tractor handles all clean-up around fleet of scattered shovels

At this large open-pit copper mine in Arizona, copper is produced from huge tonnages of rock and ore that are mined each day. Equipped with Angledozer and tilt mechanism, 210 hp Tournatractor makes quick work of clearing shovel-spillage from railroad tracks.

A large open-pit copper mine in Arizona uses only one tractor for all clean-up around their widely scattered production shovels. It is the 210 hp rubber-tired LeTourneau-Westinghouse Tournatractor®. Here's how this 17 mph tractor operates during a typical 8 hour day:

Averages 10 min. per shovel

When the 6-yd. shovels have completed loading a string of ten to twelve 84-ton capacity rail-cars, Tournatractor drives in and goes to work. Straddling the rails, this rubber-tired tractor efficiently dozes shovel spillage off tracks with its Angledozer* blade. At each shovel, speedy Tournatractor cleans-up loading area and railroad track in about 10 minutes!

Takes shortest route to next location

When each assignment is finished, Tournatractor operator just flips instant-shift lever and he's on his way to the next shovel. There are no delays for crawling or load-and-haul to new location. A mile is only a couple minutes away! Tournatractor always takes the shortest, fastest route to the next work location . . . often "runs" down steep "shot" banks to lower benches. Big, low-pressure tires do not damage air-drill hose lines, RR tracks, ties, switches, or haul road surfacing.

"You can't beat Tournatractor"

Handling all clean-up work for the shovels . . . plus completing numerous scattered maintenance jobs during his 8 hour shift . . . Tournatractor operator said, "You can't beat this tractor for clean-up work. This is the place for rubber . . . I can move around faster than a pick-up truck on some of our benches."

For more information

If you use several crawler-tractors for clean-up at your pit, plant, and stockpiles, investigate how Tournatractor's power . . . traction . . . speed . . . and "go-anywhere" mobility can pay off for you. We'll be glad to demonstrate Tournatractor at your pit . . . let you judge for yourself.

*Trademark CT-1482-M-1

Go-anywhere Tournatractor "runs" down a "shot" bank to shorten travel time between shovels. With big, multi-disc air brakes — totaling 3,762 sq. in. of brake surface — operator has sure, safe control at all times.

Crossing tracks, Tournatractor's big, low-pressure tires deflect to prevent damage. They do not loosen rails, damage ties or switches.

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

EDMUND LONGYEAR—Mesabi Pioneer

Fate called him to the Arrowhead

In the Arrowhead country of northern Minnesota lie three great iron ranges—the Vermilion, the Cuyuna and, greatest of all, the Mesabi. Collectively, these ranges represent the greatest iron producing territory in the world . . .

On June 3, 1890, Edmund J. Longyear, then a young mining engineer, sank the first diamond drill hole on the now famous Mesabi Range of Minnesota. That day his probing, diamond bit became a turning point in mining history. Along with other mining men, he subsequently explored and opened up those vast iron reserves that are still supplying the world.

DIAMOND CORE DRILLS

A complete line of core drills—surface, underground and mobile—in many models, plus drilling equipment and supplies.

GEOLOGICAL, MINING CONSULTANTS

A full staff of geologists and mining engineers serving mining companies and mining departments of countries all over the world.

CONTRACT DRILLING

Highly trained drill crews using modern Longyear equipment for mineral exploration and development and foundation testing.

Today, the E. J. Longyear Company provides the mining industry with every type of service: mining engineering, geological and photogeological surveys, contract core drilling, and the manufacture of diamond core drills and equipment.

Branch offices and an active sales organization covering 56 countries, give Longyear representation in every part of the free world.

Longyear

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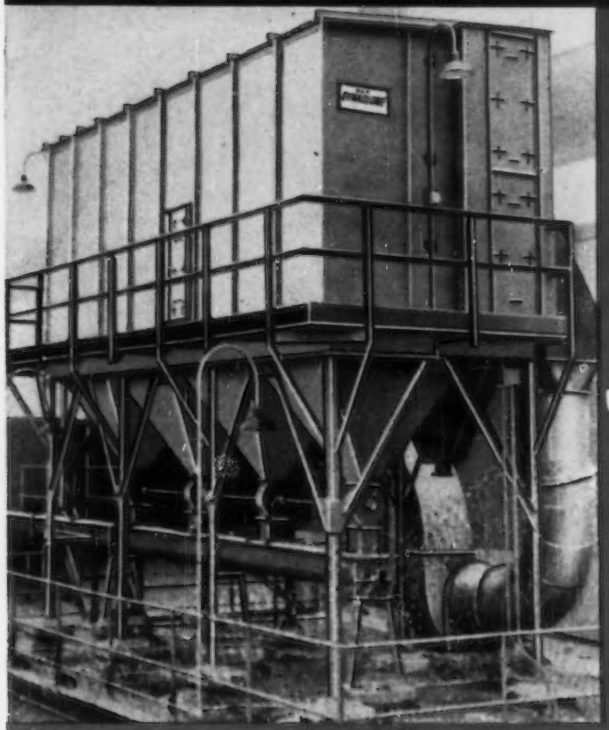
Now . . . a New High in Dust Filter Efficiency . . .



New SLY "ROLL-CLEAN" Dynaclone

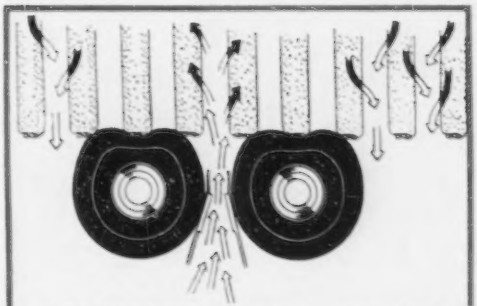
THESE NEW FIELD-PROVEN FEATURES

- Easier filter bag changing.
- Greater cloth area.
- Fewer operating parts.
- Free-rolling cleaner — no sliding.
- Complete dust seal — automatic seal adjustment.
- Easy access to all dust filter parts for inspection and servicing.

PLUS THESE TIME-TESTED DYNACLONE ADVANTAGES

- Constant suction at dust sources — complete dust collection.
- Self-cleaning for continuous operation.
- No auxiliary motors or blowers required for filter-bag cleaning.
- Greater filtering capacity and smaller space requirements — more cloth per cubic foot of filter than any other make.
- Lower power requirements.

The original self-cleaning dust filter, the Dynaclone has proven itself the most efficient dust filter ever made. The "Roll-Clean" Dynaclone combines design simplicity and rugged construction to insure even greater operating efficiency . . . even longer trouble-free service.



NEW "ROLLER CLEANER" provides greatly simplified method of cleaning dust from filter bags. Resilient rubber rolls automatically adjust to form a positive dust seal as each row of bags is cleaned by atmospheric air.

NEW CATALOG

36-page Bulletin 104 gives full details about "Roll-Clean" Dynaclone and other Sly Filters . . . contains valuable engineering information. Write for copy.

SINCE 1870 SLY

THE W. W. SLY MANUFACTURING CO.

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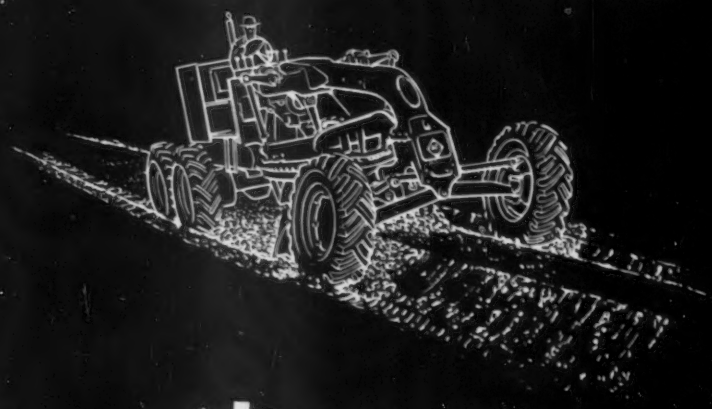
OFFICES IN PRINCIPAL CITIES

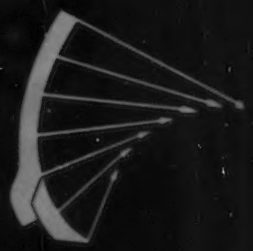


the design of the blade makes

ALLIS-CHALMERS engineering in action

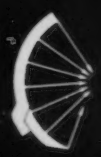
. . an Allis-Chalmers motor grader exclusive

THE ROLL-AWAY MOLDBOARD MOVES BIG LOADS FASTER



Each portion of blade forces material toward a *different* point. Packing is eliminated. Pressure and friction against blade decreases toward top of blade — no wasted power.

ORDINARY MOLDBOARD



Each portion of blade forces material toward a *fixed* point. Packing action causes high friction over entire blade — wastes power.

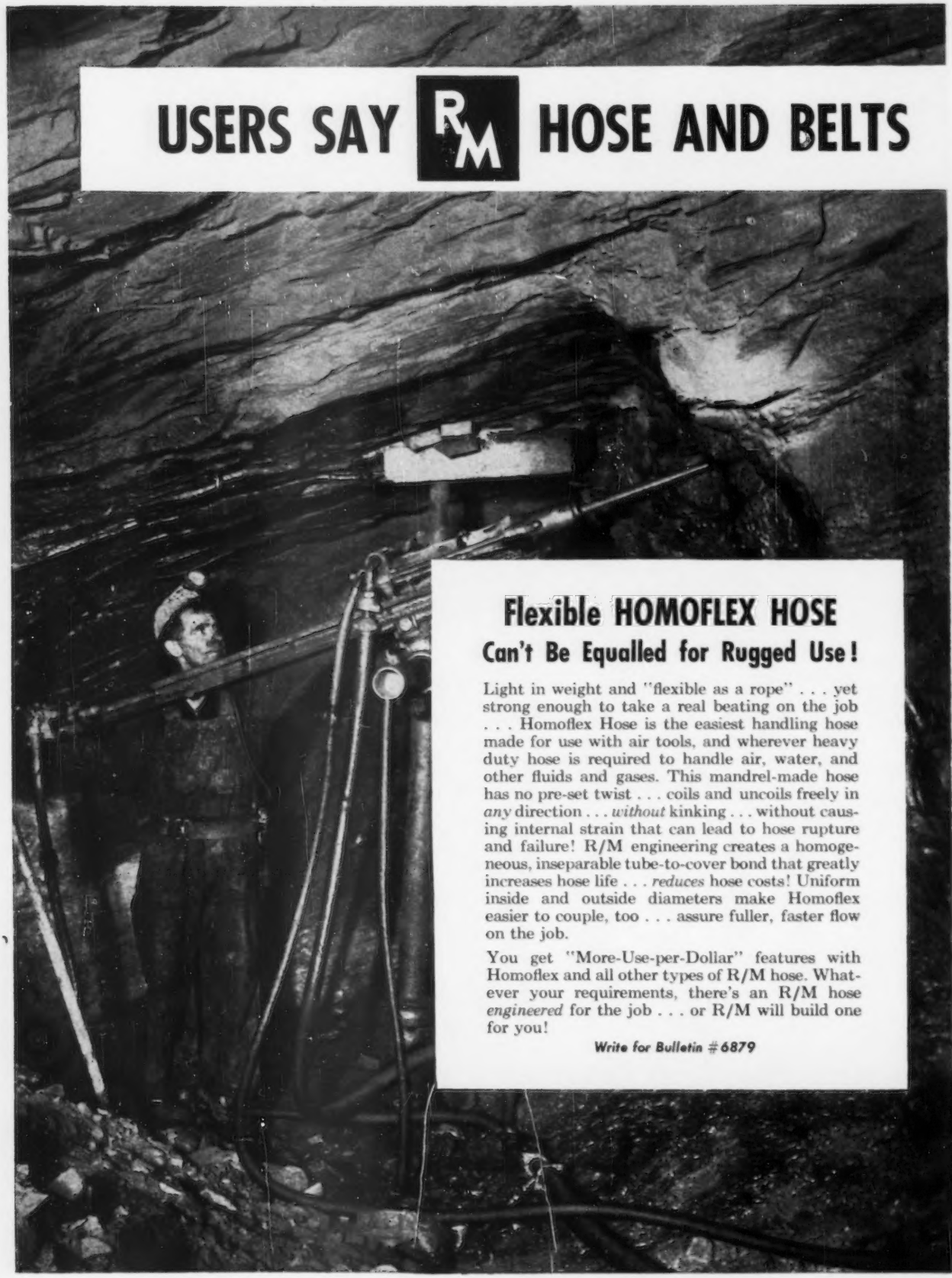
ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

the difference

ROLL-AWAY is an Allis-Chalmers trademark

ROLL-AWAY

USERS SAY R/M HOSE AND BELTS



Flexible HOMOFLEX HOSE

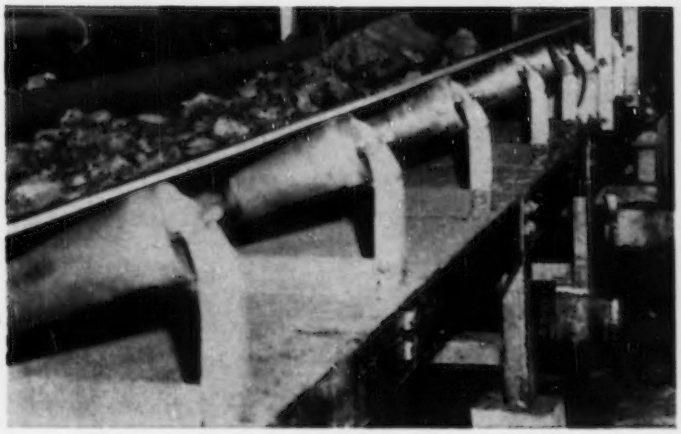
Can't Be Equalled for Rugged Use!

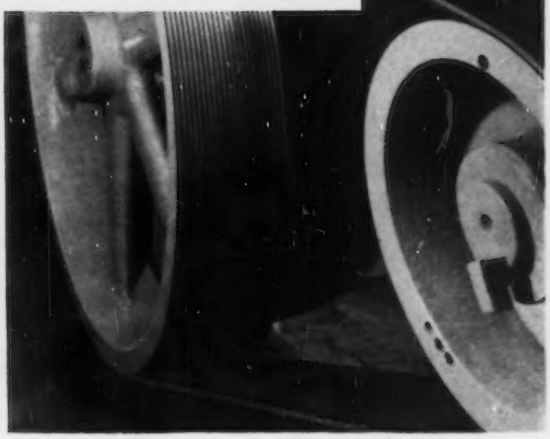
Light in weight and "flexible as a rope" . . . yet strong enough to take a real beating on the job . . . Homoflex Hose is the easiest handling hose made for use with air tools, and wherever heavy duty hose is required to handle air, water, and other fluids and gases. This mandrel-made hose has no pre-set twist . . . coils and uncoils freely in *any* direction . . . *without* kinking . . . without causing internal strain that can lead to hose rupture and failure! R/M engineering creates a homogeneous, inseparable tube-to-cover bond that greatly increases hose life . . . *reduces* hose costs! Uniform inside and outside diameters make Homoflex easier to couple, too . . . assure fuller, faster flow on the job.

You get "More-Use-per-Dollar" features with Homoflex and all other types of R/M hose. Whatever your requirements, there's an R/M hose *engineered* for the job . . . or R/M will build one for you!

Write for Bulletin #6879

GIVE YOU "*More Use per Dollar*"





RAY-MAN CONVEYOR BELT ...Lowest Cost per Haul!

Cushioned strength members . . . *double* compensation to relieve stress on outer plies . . . strength *plus* flexibility to carry bigger loads and resist ripping, *last* longer! Ray-Man requires no breaker strip . . . *holds* fasteners . . . is mildew-proof and moisture resistant. Exclusive "XDC" Cover increases protection against wear, tears, cuts and abrasion. Check "More-Use-per-Dollar" features of Ray-Man and other R/M feature conveyor belts, such as Homocord for unusually abusive shock loading, and R/M Tension-Master for long lifts, high tensions.

Write for Bulletin # 6915

R/M POLY-V® DRIVE Saves Space... Eliminates Belt Matching Problems

Single unit belt across full width of the drive sheave . . . *not* an assembly of V-belts . . . gives patented Poly-V high V-groove grip *plus* flat belt strength . . . *twice* the tractive surface to deliver up to 50% *more* power in the same space as V-belt drives—equal power in ⅔ the space! Your multiple-belt "length matching" problems are ended . . . equipment downtime and belt replacement costs are cut to a minimum! Belt and sheave inventories are cut, too . . . because just *two* cross sections of Poly-V Belt meet *every* heavy duty power transmission requirement. Let R/M engineers help determine the best Poly-V* Drives for your mine fans and other equipment.

Write for Bulletin # 6638

**Poly-V is a registered Raybestos-Manhattan trademark.*

And . . . for the "Smoothest Running V-BELTS Made" Specify CONDOR and R/M SUPER-POWER V-BELTS

RM-713

BELTS • HOSE • ROLL COVERINGS • TANK LININGS • INDUSTRIAL RUBBER SPECIALTIES

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY

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CENTRIFUGAL WILFLEY PUMPS®

This Trademark Guarantees Money-Saving Performance

Day after day, in industrial plants throughout the world, the always-dependable quality of Wilfley Sand Pumps pays off in lower pumping costs. Wilfley Sand Pumps give you all these dollar-saving features:

Maintained high efficiency
Longer pump life
Quick, easy replacement of worn parts
Rugged construction
Versatility of interchangeable materials in wear parts: hard alloy irons or soft abrasion-resistant rubber.
Simple, efficient design for trouble-free operation.

Individual Engineering on Every Application

Wilfley Sand Pumps
Companions in Economical Operation
Wilfley Acid Pumps

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Denver, Colorado, U.S.A. • New York Office: 122 East 42nd Street, New York City 17

HELICOPTER TAKES OFF on mission to search for sulphides in New England. Magnetometer, electro-magnetic instruments, scintillation counter and altimeter provide the combined information shown in curves at the bottom of the page.

How Aeroplanes Speed Mining Progress

A LITTLE MORE than a decade ago, *Engineering & Mining Journal* carried its first article on the airborne magnetometer. (June 1946) Since that time the application of the aeroplane to exploration and mining has been so rapid that it's safe to say more progress has been made in speeding up exploration and mine development during the past decade than in the previous century.

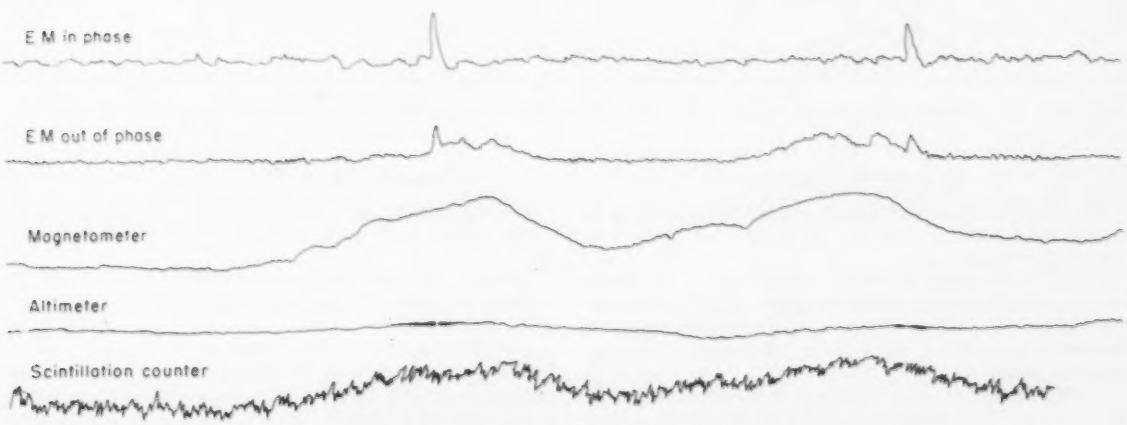
The following case histories showing how the aeroplane has been used in exploration and the development of modern mining properties are based on round-the-world projects in which the Aero Service Corp. of Philadelphia has participated, and on other surveys by government and private industry.

Sulphides in New England

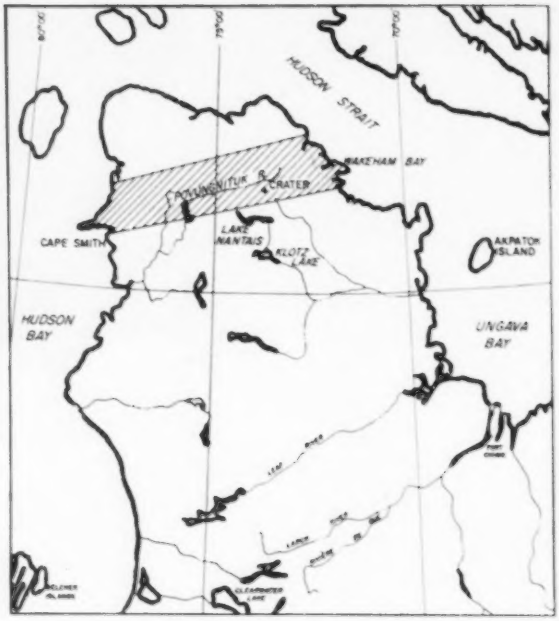
PROBLEM: Exploration for sulphide ores in brush covered, hilly New England area.

SOLUTION: Helicopter-borne magnetometer and electromagnetic detector survey, permitting tree-top level flight, following closely the contour of the land for maximum detailing of the signal in this search for copper, lead, and zinc. Comparison of magnetic record and of in-phase and out-of-phase EM signals permits evaluation of magnetic and electromagnetic anomalies, saving ground work.

SAVING: Correlated air survey information high grades the ground targets to be studied in detail.



SPARTAN AIR SERVICES BELL HELICOPTER loads up from fuel cache in Canadian Hudson Bay exploration area.

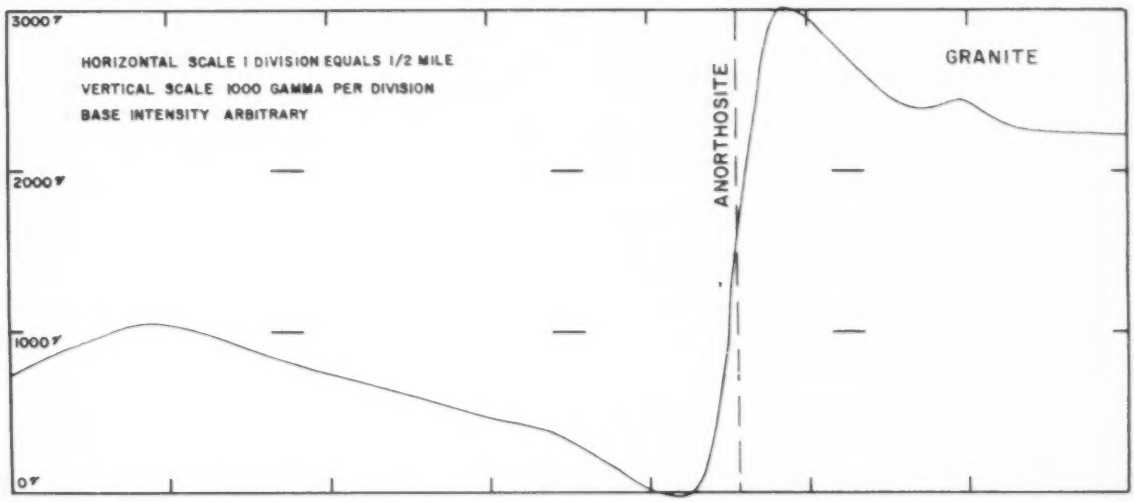


Copper and Nickel in Ungava

PROBLEM: Search for copper and nickel deposits in 7500-sq mile area in Canadian sub-Arctic—northern Ungava area.

SOLUTION: Photo-maps of area made from air-strip temporary base, bulldozed from ice and snow at Esker Lake. Forty-man task force performed airborne electromagnetic survey with two aircraft operating throughout long daylight hours of Arctic spring. Flight altitude: 500 ft.

SAVING: Detailed geophysical data over a large area rapidly obtained for 30-plus mining companies jointly underwriting this project. Survey completed in spring months in time for ground follow-up. It is believed that all massive, near-surface sulphide bodies (target of the survey) will have been picked up.



MAGNETOMETER READING shows a sharp rise at the contact between the granite and the anorthosite formations in Quebec.

Ilmenite in Quebec

PROBLEM: Determine limits of anorthosite deposit in Allard Lake area, Quebec, to define area of possible ilmenite deposit.

SOLUTION: Airborne magnetometer survey at 4-mile spacing, 500-ft altitude, flown at right angles to supposed edge of the anorthosite. The anorthosite-granite contact is charted by recognition of the large and characteristic magnetic anomaly.

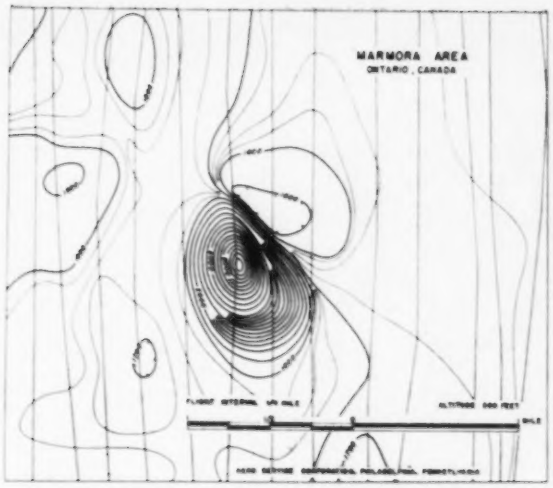
SAVING: Anorthosite limits are determined accurately in days, instead of a season or more of field work.

Ilmenite-Hematite in Quebec

PROBLEM: Investigate known ilmenite-hematite deposit within Allard Lake area, and prospect for additional deposits.

SOLUTION: Airborne magnetometer survey, at 500 ft altitude with ¼-mile spacing, more than a distance of 4,500 linear miles.

SAVING: Survey was successful, completed in small fraction of time required for ground traversing methods in this rough, heavily timbered area completely void of roads or other means of access.



THUMBPRINT ANOMALY on aero-magnetic map of Canadian Department of Mines resulted in major iron-ore find.

Iron Ore in Ontario

PROBLEM: Location of new magnetite deposits in general area of iron ore formations in Ontario.

SOLUTION: Reconnaissance survey with the airborne magnetometer by Dept. of Mines and Technical Surveys of Canada at 500 ft height, with ¼-mile flight line spacing.

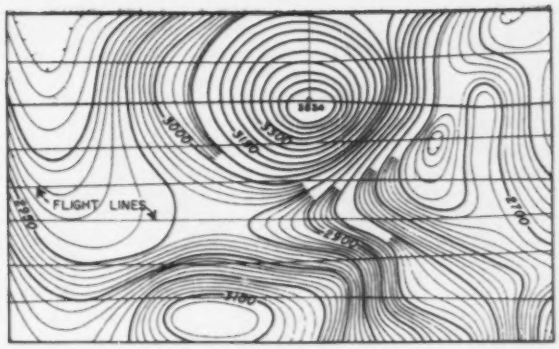
SAVING: Survey uncovered major deposit in a new area buried under 200 ft of limestone.

Nickel in Canada

PROBLEM: Search for new nickel deposits in Canada.

SOLUTION: Airborne magnetometer surveys, flown at 500 ft with ¼-mile spacing, to aid in general geologic mapping and to spot areas of increased mineralization.

SAVING: Necessary ground survey crews put in the field in the most likely areas, seasons ahead of timing possible if ground reconnaissance only had been used.



MAGNETIC PEAKS such as these were picked up in airborne survey over previously unknown iron orebody in Pennsylvania.

Blind Iron Orebody in Pennsylvania

PROBLEM: Reconnaissance of 700,000-acre blind area in eastern Pennsylvania for major magnetite body.

SOLUTION: Airborne magnetometer survey, flown at 500 ft, within ¼-mile spacing.

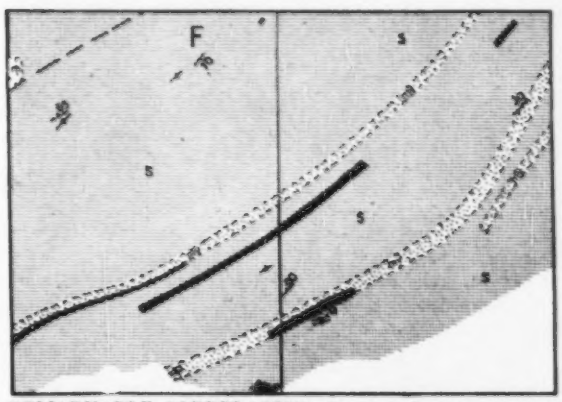
SAVING: Major body at depth of 1,500 to 3,000 ft uncovered. Preliminary results delivered within few days after survey flights; final maps within four months. Cost: 7c per acre, much less than ground surveys.

Community Planning in Canada

PROBLEM: Locate and plan mining community to work newly discovered uranium find at Elliot Lake, Canada.

SOLUTION: Aerial photo reconnaissance to provide general information concerning area. Photo-interpretation to provide information concerning soils, timber, potential fill areas. Topographic maps from aerial photos for engineering planning and construction of roads, sewers, etc.

SAVING: Only aerial surveys make possible the rapid collection of the engineering and planning intelligence needed to begin construction almost overnight of this new community.



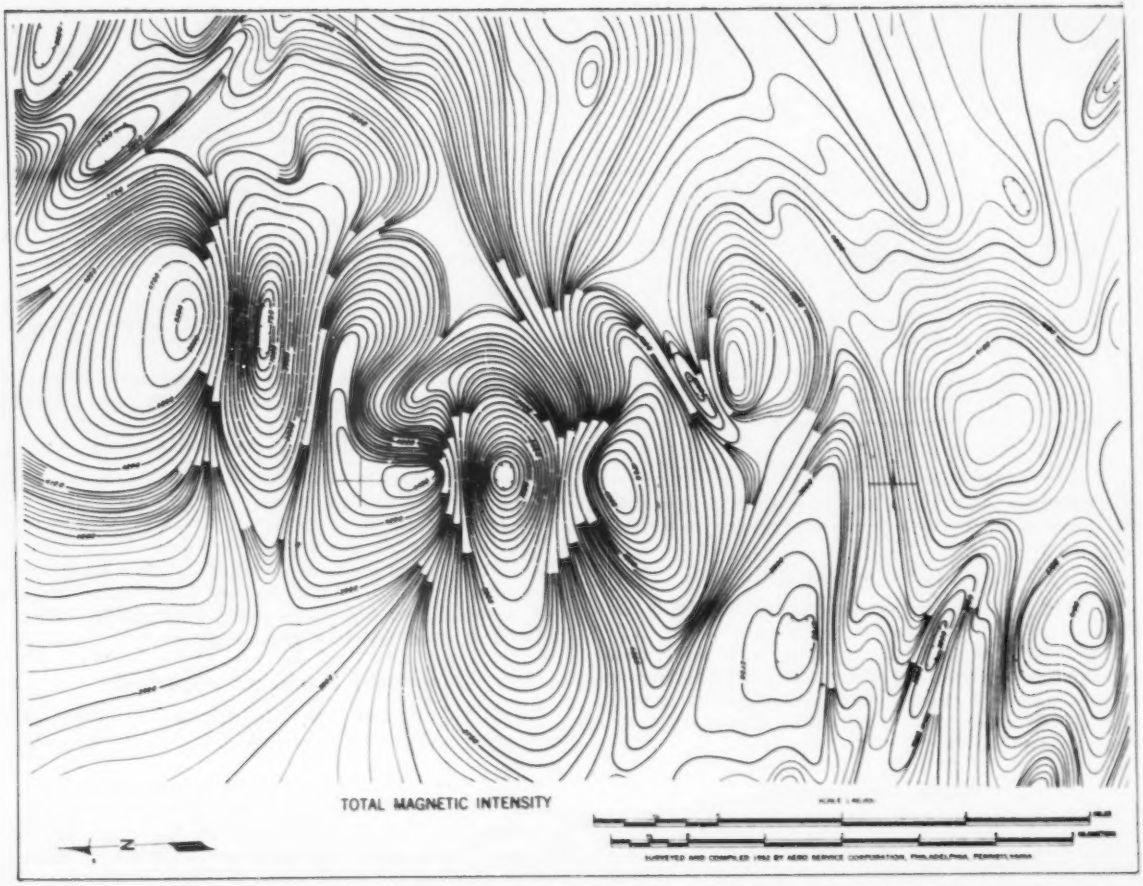
REMARKABLE CORRELATION shows up between ground-mapped ultra-basic rocks (black) and structural features for the identical area as indicated by the configuration of magnetic contours picked up by airborne magnetometer in Maine.

Asbestos in Maine

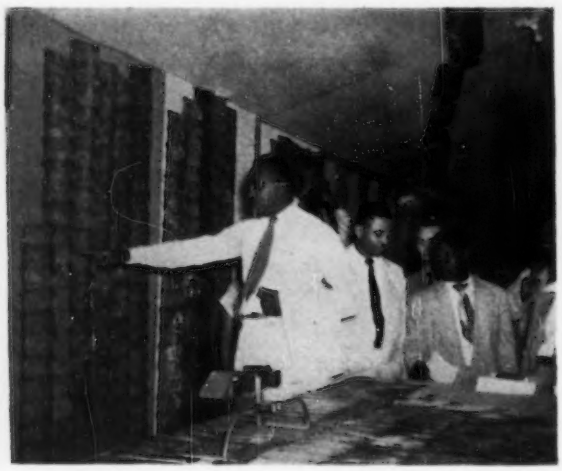
PROBLEM: Finding asbestos deposits in known serpentine area in Maine.

SOLUTION: Airborne magnetometer survey to delineate the ultramafic rocks in which asbestos mineralization may have taken place. Flight line spacing: 2 miles (because bodies were known to be long in extent, not pod-like). Flight altitude: 500 ft, except where terrain permitted 300 ft.

SAVING: Survey flown during first 2 weeks in May; preliminary maps delivered first week in June, in time for summer field use. At cost of $10,000 for air survey and 10 man-months of field exploration, definite conclusions were obtained about large areas to be eliminated and about best targets for detailed ground studies.



THIS IS THE TYPE of magnetic anomaly that is being sought as the target in Liberian iron-ore surveys. Note that in Equatorial areas, orebodies are marked by strong lows bounded at north and south ends by strong magnetic highs.



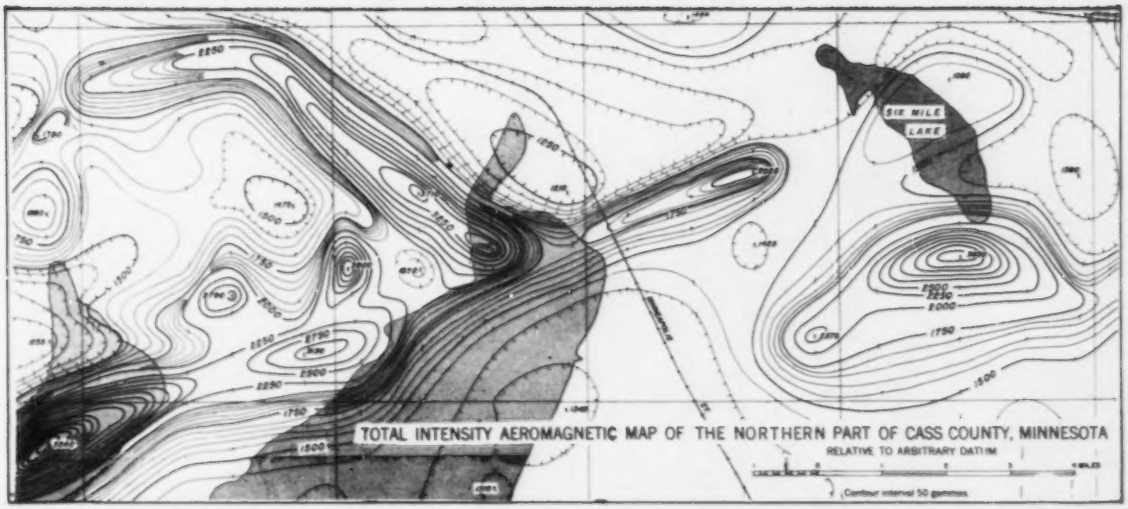
OFFICIALS OF LIBERIAN GOVERNMENT inspect magnetometer, plane, and numerous mosaic maps used in broad aerial survey.

Magnetite in Liberia

PROBLEM: Search for magnetite over 6,000-sq miles of dense, undifferentiated Liberian jungle, with no positional reference points.

SOLUTION: Airborne magnetometer survey guided by Shoran, precision radio location tool, at ½-mile flight spacing. Flight altitude: 500 ft.

SAVING: Jungle virtually impassable for ground parties. Screening surveys of large area impossible by ground methods, but economical and fruitful by aero-geophysical mapping methods.


SIX MILE LAKE
TOTAL INTENSITY AEROMAGNETIC MAP OF THE NORTHERN PART OF CASS COUNTY, MINNESOTA
RELATIVE TO ARBITRARY DATUM
Contour interval 50 gammas

HIGH-ALTITUDE AIRBORNE magnetic survey by the U. S. Geological Survey was made to outline the mineralized area of Minnesota on a broad regional basis. North-south flight lines were spaced at about one mile. Contour interval is 50 gammas.

Checking Up On Regional Anomalies

PROBLEM: Follow-up of interesting anomalies developed from U. S. Geological Survey regional, air magnetic maps of Minnesota.

SOLUTION: Airborne magnetometer surveys at 1/10-mile interval, at 300-ft flight altitude. These surveys differentiate between anomalies seen as almost identical on regional maps, showing some to be disseminated magnetite and others to be concentrations of ore quality.

SAVING: Surveys permit rapid, secret, detailed evaluation of prospects prior to lease negotiations.

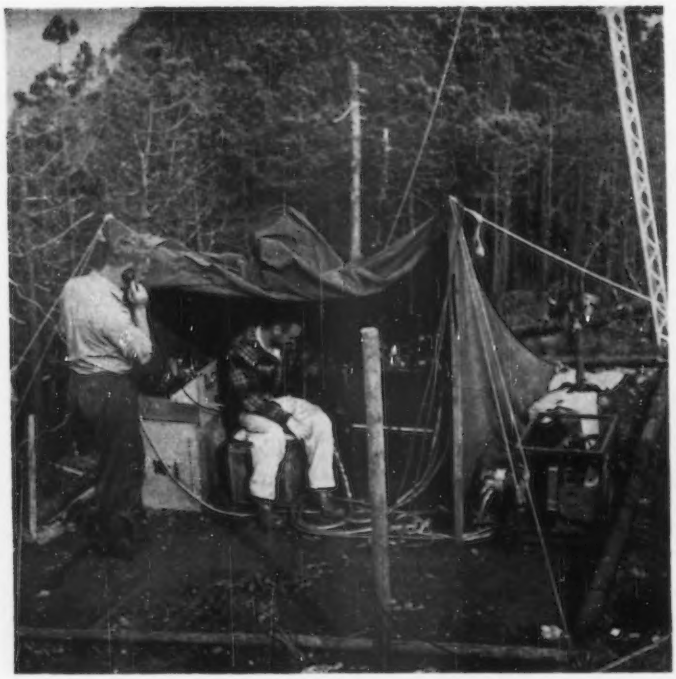
LIGHT CRAFT, such as this aeroplane, fitted with airborne magnetometer built into the tail (lower right) is suitable for the search for magnetite in western areas of the United States. The small craft operation, while economical, is also limited in range.

Magnetite in the Western States

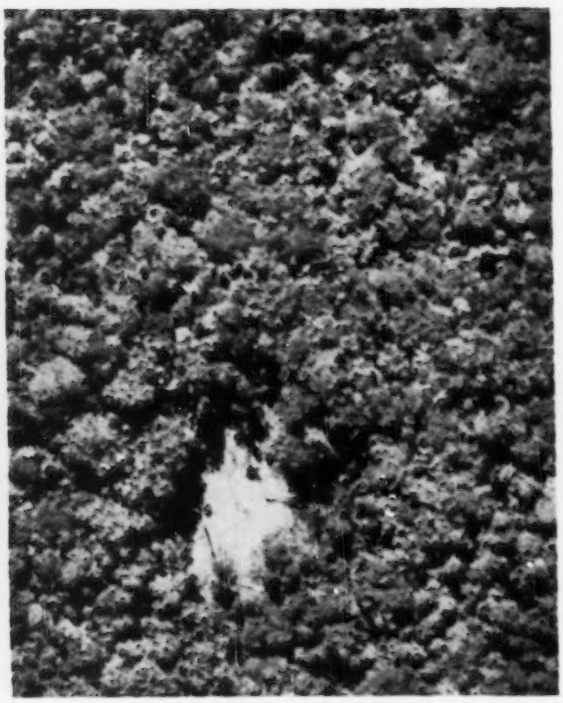
PROBLEM: Search for magnetite in several areas of the western United States.

SOLUTION: Airborne magnetometer surveys at 500 ft altitude, with ¼-mile spacing. Immediate examination of magnetic data by company geologist with air survey staff in field permits detailed studies of areas of interest as quickly as they develop.

SAVING: Competitive searches under way place premium on quick decisions. This method is fastest means for spotting anomalies and promising areas.



SHORAN EQUIPMENT and shoran control tower established in Guatemala jungle to determine plane flight position at all times



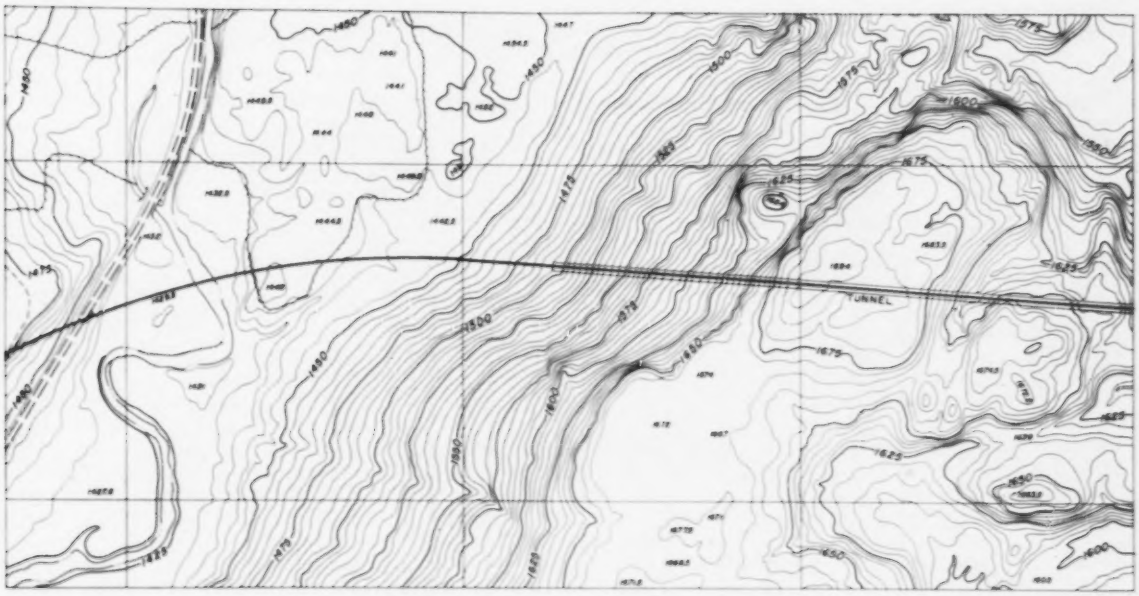
GROUND CREW MEMBER of Guatemala survey inspects control point monument. Bird's-eye view of point is at right.

Concession Mapping in the Jungles

PROBLEM: Defining concession boundaries over large, jungle or bush-covered unmapped areas.

SOLUTION: Shoran-positioned aerial photographs of area, tied to known or specially surveyed ground points. This aerial triangulation provides boundaries accurate to within ± 150 ft. Photos above show Shoran equipment.

SAVING: Costs are very much less than ground surveys. By Shoran, lines as long as 300 to 500 miles can be measured in one day's flying. Thus triangulation programs which might take years by ground surveys are completed swiftly by Shoran. Shoran's accuracy is such that the U. S. Government is using it to mark out guided missile ranges.



FINAL LOCATION OF RAILROAD was made with this 5-ft contour-interval map with horizontal scale, 1 in.=200 ft.

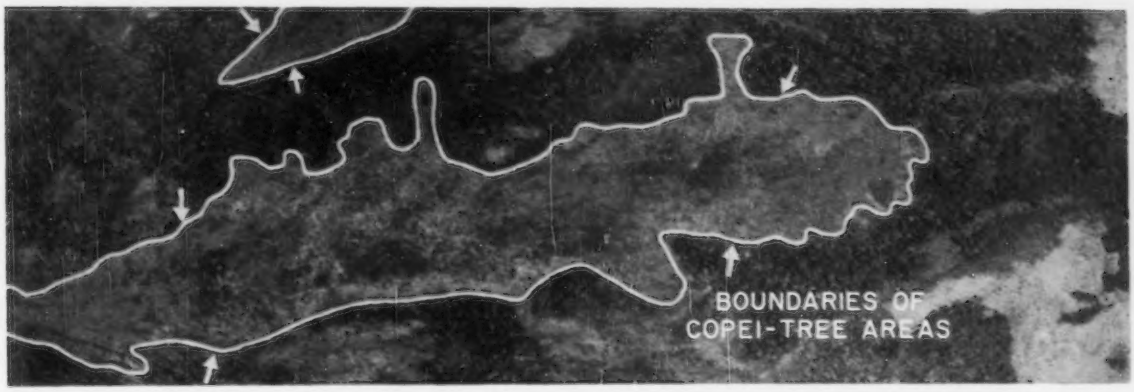
Mine Railroad Location In Minnesota

PROBLEM: Location of 75-mile railroad over swamp and brush covered area from Hoyt Lakes, Minn., to Lake Superior port, for Erie Mining Co.

SOLUTION: First step was aerial photographs of six-mile wide route strip, at scale of 1:40,000. These were assembled in controlled photo-mosaic or photo-map, showing location of swamps and ridges, as well as variations in types and density of timber, and soil conditions. These photos were also base for 25 ft contour map, at scale of 1 in.=800 ft. Several trial routes were laid out on this contour map and the photo map, with frequent reference to the stereo-photos.

After railroad location was narrowed to one-mile route strip, new photos of this area were made at 1:12,000, and topographic maps prepared from these photos at scale 1 in. =200 ft with 5-ft contours. This map and the 1:12,000 photos were used to designate the final route and center line, and to estimate engineering and construction costs. Final phase of the program was staking center line, cleaning a path 20 ft wide.

SAVING: Complete surveying, mapping and location work was finished in 1½ years, so construction contracts for 75-mile of railroad were executed and in active progress less than two years after the first planning. Tamarack and cedar swamps, along with brush and heavy tree growth, and seasonal plagues of black flies, made ground reconnaissance almost impossible.

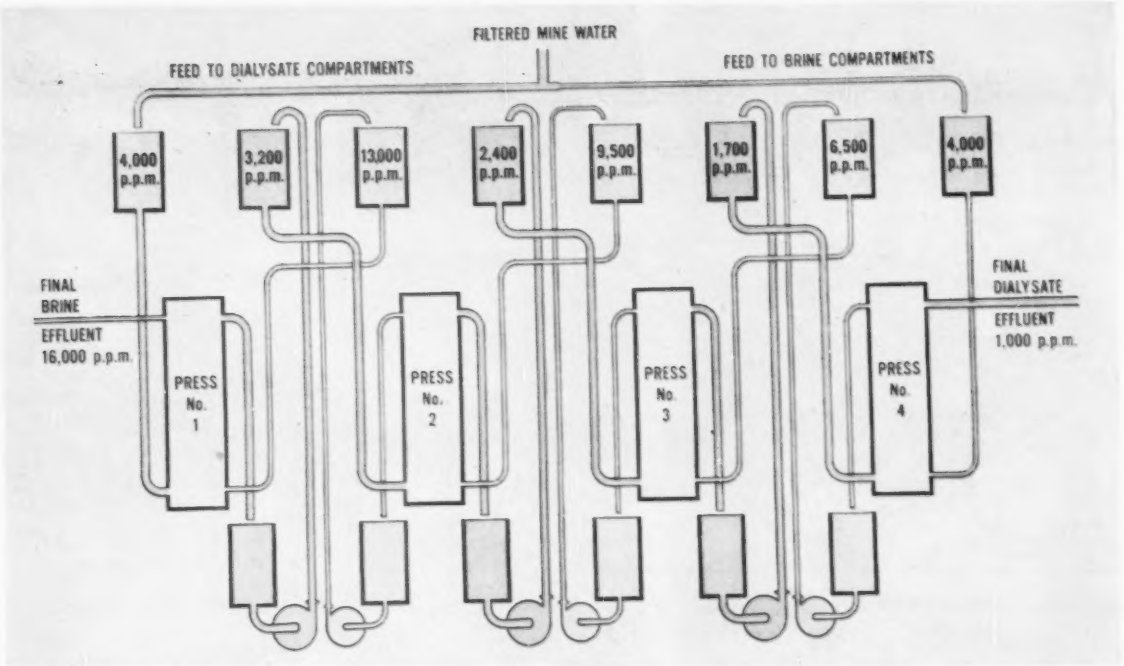


Iron Ore in Venezuela

SURVEY PROBLEM: Aerial reconnaisance of region south of Orinoco River, in Venezuela, an area about the size and shape of Massachusetts, Connecticut and Rhode Island, to provide topographic information for ground parties, and for photo-geologic studies.

SOLUTION: Aerial photography at scale of 1:40,000 for 11,000 sq miles. Started late one year, completed at close of dry season following year. Mountain landslides, caused by silicas having washed away from ferruginous quartzite, were noted in stereo-examination of air photos and proved vital clue to Cerro Bolivar discovery. Air photos also helped to delineate extent of orebody because distinctive vegetation (copei-tree) associated with such soil could be defined on photos. See illustration shown above.

INDEX OF SAVING: Magnetite body estimated at 500-million tons was found. Years of ground exploration work saved.



PILOT PLANT at Welkom Gold Mines put mineralized water through four presses, with reduction from 4,000 ppp to 1,000 ppm.

OFS Mines Defeat Salt Water Problem

W. H. MOYERS

A COMBINATION of close cooperation, intense research and adaption of the process of electrodialysis has given the Orange Free State gold mines an answer to two of their most difficult problems. Some 18-million gallons per day of very salty underground water are produced by the mines and the figure is expected to go to 30-million gpd by 1960.

The salts render the water unfit for domestic consumption and even for agricultural purposes. The water cannot, therefore, be discharged on to farming lands without damaging crops and grasses and the soil itself. Nearby streams of natural water would be overwhelmed by the addition of the immense volumes of brackish water pumped daily from the mines; and its disposal along natural water courses is, therefore, not permissible. Although this salty water can be used in gold reduction plants, its chemical content makes it unsuitable for use in the process of extracting uranium from the residue slimes of the gold mines. Hitherto, the only means of disposing of this water had been to evaporate it in natural pans and specially constructed dams. Vast areas of land have had to be bought for this special purpose and many miles of canals and numerous dams have had to be constructed. The volume of water to be evaporated increased from 13-million gallons a day in 1954 to 18-million gpd in 1956; and it is estimated that there may be as much as 30-million gpd to be disposed of by 1960. The mines have already purchased all suitable land close at hand for evaporation purposes and have had to construct large pipelines many miles long and install large pumping plants to carry the surplus water to distant unused pans as volume increases.

Naturally much thought has been given to the question whether something could not be done to make this water fit for use in one way or another. It is paradoxical that the mines have to buy millions of gallons of water every day for mining and extraction purposes—this water is pumped from the Vaal River 40 miles away—and at the same time have to spend large sums of money to dispose of millions of gallons pumped from underground. Unfortunately, all conventional methods of purification, such as distillation and ion exchange, are uneconomic, even when present costs of consumable water supply and brackish water disposal are taken into account.

In 1952 it was learned that a process for demineralizing salty water, known as electrodialysis, was being developed in various countries overseas. Although the process appeared promising, it was still in the laboratory stage. Early in 1953 the National Chemical Research Laboratory of the South African Council for Scientific and Industrial Research (CSIR) started investigations into the process. Officials of Anglo American Corporation of South Africa, Limited, and the Council discussed the possibility of the process being applied to the problem of brackish water disposal in the Orange Free State. From these discussions it soon became apparent that the South African Council for Scientific and Industrial Research was as far advanced in knowledge of the process as any other research organization in the world; and it was agreed, in July 1953, that the corporation would help both financially and technically with investigations into the possible development and application of the process. One of the conditions was that work would be confined specifically to the problem of desalting Orange Free State mine water from 4,000 parts per million total dissolved solids (3,800

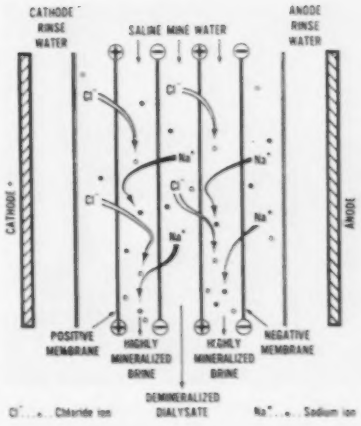
Mr. Moyers is a civil engineer with Anglo-American Corp. of South Africa. This article first appeared in the magazine *Optima*, and is used by *E&MJ* with the permission of the publishers.

ppm sodium chloride) to 1,000 ppm, at which level it could be used for irrigation purposes.

When a salt such as sodium chloride dissolves in water it breaks up into two groups of ions: sodium ions, which carry a positive electric charge (Na^+); and chloride ions, carrying a negative charge (Cl^-). Water containing salts in solution is said to be mineralized. In the electrodialysis process, water which is to be demineralized is passed through a narrow compartment between two membranes, known as a "membrane couple", and at the same time it is subjected to an electrical field at right angles to the membranes (see diagram). The membranes are permeable to ions but are so constituted that one of the two membranes will permit the passage through it of only positive ions (the membrane is called a negative membrane) and the other only negative ions (a positive membrane). Under the influence of the electrical field the ions causing the mineralization migrate through their respective membranes into streams of water coursing through adjacent compartments. These streams, which carry the ions away, are known as "brine streams" and in the process are apt to become heavily mineralized. The remaining water, from which part of the salt has thus been removed, is known as the "dialysate". A dialysis "press" consists of a large number of alternate brine and dialysate compartments. Any tendency of the ions to escape from a brine compartment back into a neighbouring dialysate compartment is resisted by either the electric field or the membranes. In practice there may be 200 or more membranes assembled in what is known as a "pack". Several packs are then assembled together between one pair of electrodes to form a press. Desalting can also take place in stages (i.e. the water is passed through several presses in succession so that a portion of the salt is removed by each press in turn).

Initially a small press, based on a Dutch design, was built and operated in the Pretoria laboratories of the South African Council for Scientific and Industrial Research.

This press was used to test the theoretical calculations for the design of a larger pilot plant that was later to be built at Welkom. It was also used for testing and comparing membranes manufactured overseas with ones developed in the CSIR laboratories. It had a capacity of 250 gallons per hour with a desalting range of about 800 ppm. This meant that the water had to pass through the press four times to be desalted from 4,000 to 1,000 ppm. At first synthetic



MEMBRANE COUPLES reduce salt in the dialysate, increase brine strength.

salty water was used but later barrels of mine water were railed up from Welkom. By April 1954 the experiments had proved so successful that other mining groups with mines in the Orange Free State had become interested, and it was decided that Anglo American Corp. should enter into a formal agreement with the CSIR on behalf of all Orange Free State mines, whereby the CSIR would act as consultants for a pilot plant to be erected and operated by the mines.

Design of the pilot plant started in August 1954. It was decided to erect it at the Western Holdings mine, adjacent to a million gallon dam containing water pumped up from the underground workings of No. 1 shaft. The plant was capable of treating 1,000 gallons an hour to produce 800 gallons an hour of dialysate containing 1,000 ppm of salt, and 200 gallons an hour of brine containing 16,000 ppm.

For flexibility it was decided to use four presses placed in series. This allowed continuous flow through the plant with four-stage demineralization.

The press consists of a steel frame holding four membrane packs. Each pack is made up of 100 compartments bolted together between two plastic plates. The electrodes are placed in the two outer (or end) plates and a continuous path for the electric current is provided by circulating concentrated brine through the intermediate plates. The dialysate and brine streams are fed into the packs through channels in the plates which are connected up so that the flow is in parallel through the four packs.

A simplified flow diagram for the whole plant is shown on page 84. From this it is seen that the saline mine water coming from the pretreatment plant, where all suspended matter is filtered out, is pumped into two overhead tanks which feed the dialysate and brine compartments of the first and fourth presses respectively. On leaving the first press the dialysate is pumped up to the second tank, gravitates through press 2 and so on, gradually losing salt in each press till finally discharged on the right. The brine which starts at No. 4 press and gets more and more concentrated as it passes through the presses is finally discharged from No. 1. In addition, there are three other small streams of water which are not shown in the diagram. These are two rinse waters for washing away the sodium hydroxide and hypochlorous acid and free chlorine which collect in the compartments next to the electrodes, and the concentrated brine rinse flowing through the intermediate plates. The area of each electrode, i.e. the effective area of each membrane, is 124 square in. (800 square cm.).

Many difficulties were encountered in designing and constructing the presses. They had to be of a different design from the one used in Pretoria because of the greater number of compartments and the higher voltages and currents required. Everything had to be worked out from basic principles and tried out in the Pretoria press or by means of models. All materials used had to be resistant to corrosion. Also it was difficult to persuade manufacturers to make items not in common use.

Membranes were not available in sufficient quantities, nor was it felt that any produced overseas were really satisfactory for various reasons. The CSIR had, however, had some success in making, from parchment, cheap, efficient membranes that gave promise of a reasonable life. It was decided, therefore, to continue membrane depelopment work and the mines provided the necessary equipment to manufacture the membranes in the CSIR laboratories on a fairly large scale.

The electrodes were manufactured from special steel by a patented process in Holland. A South African plastics firm carried out a great many experiments before developing a method of casting the intermediate and electrode plates, using an epoxy resin reinforced with fiberglass.

To separate and support the membranes and also to ensure turbulent flow in the compartments, a corrugated, perforated spacer material was required. The thickness over the corrugations had to be only 1/16 in. for three of the presses and a mere 1/32 in. for the fourth one. A source of perforated plastic sheets was discovered in England but a special machine

HARTEBEESTFONTEIN GOLD MINE is one of the many OFS properties which will benefit from the desalted water now being produced by the dialysate process.

MERRIESPRUIT GOLD MINE thickens and concentrates uranium before processing at the nearby Virginia G.M. Before process, salty underground water was unusable.

had to be designed and constructed to do the corrugating in Pretoria.

Eventually most of the difficulties were ironed out, and the first press was installed in the plant in September 1955. As a result of initial tests various minor modifications were made to the design for the other three presses, which were installed by the end of January 1956.

The plant was then run as an integrated plant on a 24-hour basis. Tests were done using varying flow rates in the plant as a whole and in individual presses; the current densities in the presses and hence the voltages were varied; the way the streams were fed into the packs was changed; and a hundred and one different effects were studied. The power required for desalting over different ranges down to 500 ppm was assessed. Also, as membrane development work proceeded in Pretoria, new types of parchment membranes were installed for testing.

Months of continuous field operation produced many peculiar phenomena and unexpected practical difficulties that do not reveal themselves during laboratory tests of only a few weeks' duration. One of the most baffling phenomena was a very gradual decrease in the efficiency of press No. 1. This was eventually traced to a scale forming on the membranes in the brine compartments, which took months to become visible. X-ray analysis was required before the scale could be identified as a barium and strontium sulphate solid solution, formed from these elements, which occur in minute quantities in the mine water. The scale forming was serious, because, if the scale could not be removed, it would seriously limit the life of the membranes. A means was eventually evolved whereby the scale could be removed. This necessitated stopping the pilot plant for a short period twice a week. It has been possible, however, to design a plant where descaling can be carried out without stopping the process. Descaling immediately restores the efficiency of the membranes and ensures a minimum life for CSIR membranes of nine months.

These tests continued until January 1957, with runs of up to a month's duration. The plant was then put on to a continuous run of 24 hours a day, 7 days a week for 3 months, in order to assess the susceptibility of the plant to breakdowns. Including descaling operations, power shutdowns and other breakdowns, the plant was "offstream" less than 5% of the time.

During March and April, the steel electrodes were replaced by ones made of graphite, which, although they have a shorter life, are much cheaper. The main reason for the change was that corrosion of the steel electrodes precluded the use of the electrode rinses in the pre-treatment plant, where they were required for flocculating and conditioning the water.

By April 1956 it was apparent that a large-scale plant was an economic possibility, and preliminary estimates were prepared for a plant capable of treating 3-million gpd of mine water, to produce 2.4-million gallons of water with a salt content of not more than 1,000 ppm. The estimates showed that the cost of the purified water produced by a plant of this size would be about 2s 6d per 1,000 gallons.

Detailed designs were also started for a large-scale prototype press to hold one pack of 200 membranes, although, in the full scale plant, there would be many packs in each press. The over-all size of the membranes was decided on as being 5 ft 6 in. by 2 ft 2¾ in., with an effective size of 3 ft 10½ in. by 1 ft 10¾ in., giving an effective area of 1,060 square in. (6,850 square cm). Experiments were started in July 1956, on a full-scale model of a press this size, made of perspex, to try to develop a better method of distribution to the various compartments. Eventually, a way was found whereby the water could be fed into the compartments by an improved method which gave an even flow over the whole effective area of each membrane. Concurrently, experiments were carried out to prove the feasibility of making membranes of the required size.

The decision to build the prototype press was taken in November 1956. Manufacture was completed and it was erected by the end of May 1957. The main difficulty was the electrode plates which, incidentally, are probably the largest castings of polyester resin reinforced with fiberglass yet made anywhere in the world. In June 1957, hydraulic and electrical tests were made on the press and these proved highly successful.

In December 1956 decision was made to design a plant to treat 3 million gpd in the light of the results of the experiments carried out up to

that date. It was also decided to put out an inquiry on a world-wide basis asking for firms to apply for consideration as potential licensees for the patents in respect of the CSIR membranes, as the numbers required for a large plant were beyond the manufacturing capabilities of the CSIR laboratories. Firms were also offered certain CSIR electrodialysis plant patents. Replies were received from nearly every firm in the world that has been conducting research in this field and also from many other firms wishing to enter this market. Eventually, agreement was reached with a British firm which will initially manufacture membranes in England but later will transfer the plant to South Africa.

By March 1957 preliminary plans and detailed estimates were completed. These showed that the cost of treating 3-million gpd of saline water containing 4,000 ppm of salts to produce 2.4-million gpd of water containing 1,000 ppm would be a maximum of 2s 6d per 1,000 gallons of purified water. These estimates of cost included provision for interest and redemption of capital.

Consideration was also given to the case of water from the Free State Geduld mine. This mine has one of the worst water problems in the Orange Free State but its water contains only 3,000 ppm of salts. It was estimated that the water from this mine could be demineralized to 500 ppm for 2s 6d per 1,000 gallons. As water of this low salinity (500 ppm) complies with the South African Bureau of Standards' requirements for domestic water supplies and can also be used in uranium plants the decision was taken to erect a plant at Free State Geduld mine. Most of the mines in the Orange Free State are contributing to the cost of this plant so that they can benefit from the lessons learned from its construction and operation: they can then decide to build their own plants as required.

Work has already started on the construction of the plant, which will supply the whole of the fresh water requirements of the Free State Geduld and Western Holdings mines and, in addition, a large proportion of the water required for use in the Welkom mine uranium plant.

The plant will consist of two sections, a pre-treatment plant where the water is filtered and conditioned, and an electrodialysis plant. The latter will be housed in a building 166 ft long by 70 ft wide by 30 ft high. Desalting will be done in two stages; each stage will consist of four very large presses, so that the flow through each press will be 25,000 gallons of dialysate and 5,000 gallons of brine an hour. In addition, there will be one spare press, which can be brought into operation in either stage whenever one of the presses has to be taken out of action for maintenance or repair, and replacement of membranes, and electrodes. Each press will consist of 10 packs of 200 membranes each. The membranes will each be 7 ft by 2 ft 2¾ in. with an effective area of 1,516 square in. (9,780 square cm.). i.e. more than 12 times the area of a pilot plant membrane.

The presses will be about 15 ft high and 12 ft long and each will require four 5-ton hydraulic jacks to supply the sealing pressure required to prevent leakage between the gaskets and membranes.

All controls and gages will be situated in one room so that a single operator can control the whole plant. He will even be able to carry out descaling operations from the control room. A recorder will show him the degree of salinity at five different points in the plant so that he can adjust flow rates and power to suit variations in salinity and temperature in the incoming mine water. Once a particular rate of flow is set in any one pipeline, automatic valves will ensure that the flow remains constant.

Power Required

The amount of power required for electrodialysis varies with the temperature of the water and with the efficiency of the membranes, which deteriorate slowly over a period of many months. The estimated maximum quantity required when using old membranes in winter time, during which the less efficient general temperature prevails, is 1,600 kw. A further 200 kw will be required to operate the pumps, and other equipment.

As stated previously, the estimated maximum cost of treating the water, including provision for interest and redemption of capital, is 2s 6d per thousand gallons; but it may well be lower because the prototype press has proved more efficient than anticipated.

Purified water from this plant will be sold to the mine consumers at 2s per thousand gallons, which is the price they have to pay for water from the Vaal River. In addition, the mines will pay approximately 3d per thousand gallons, which is the cost to them of evaporating underground water in dams. The expected net result is that, from an economic point of view, the plant ought to produce demineralized water at about the same cost as the mines now pay for both the fresh water supply and the disposal of underground water. Vast areas of land that would otherwise have to be used for evaporation purposes will be saved for productive agriculture, and surplus Vaal River water supplies will become available for other purposes elsewhere.

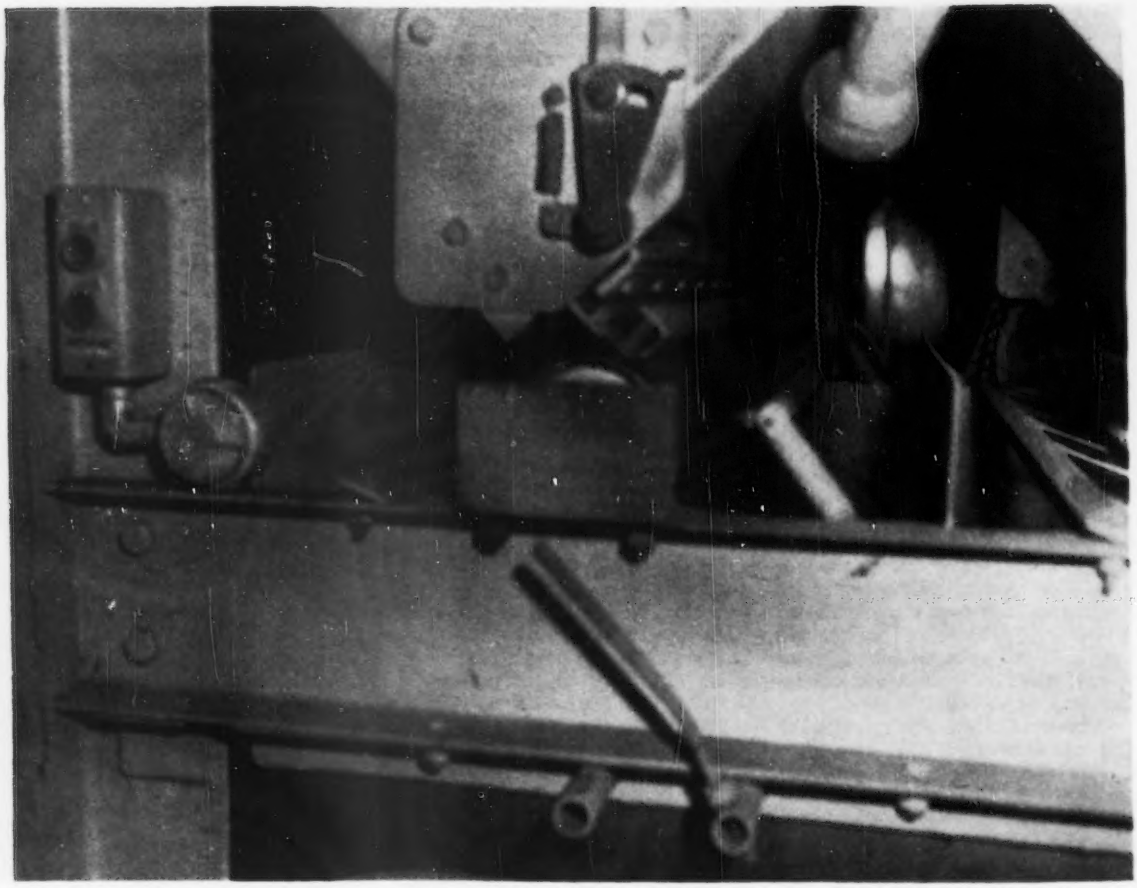
The proposed plant is expected to be commissioned in 1958. It is a big step forward in the efforts being made all over the world to develop methods for desalting saline waters. The plant will be the largest of its kind in the world. Nearly all plants developed hitherto in any country by government-sponsored agencies or commercial firms are still in the laboratory stage and the few that have progressed to a semi-commercial scale are also very small, the largest being about the size of the Welkom pilot plant. The press to be used at the new plant will be the largest yet constructed. The economic success of the process has been assisted by the very low cost of the membranes. Another claim made for the CSIR membranes is that they are the only membranes known to have been tested under field conditions for a period longer than the useful life claimed for them.

It seems likely that, through using South African patents, it should be possible to demineralize water on a large scale at a cost much less than the cost of other processes.

South Africa's lead in the electrodialysis field can be attributed to the fact that a specific problem, covering a definite range of salinity, had to be solved, and for the solution the vast resources of the CSIR and the mining industry were available in close and cordial co-operation. The tremendous enthusiasm shown by all members of the team working on the project has contributed importantly to this success.

The potential applications of demineralization are considerable. There are vast tracts of the world where development is limited or stifled altogether because the only water available is too saline for human or animal consumption. It is confidently anticipated that the lessons learned from the experiments described and those yet to be learned from the operation of the big plant will lead to the construction of many plants supplying water to towns, power stations, stock farmers, mines, and other organizations and units in areas that are now considered useless desert. Eventually it may be possible so to cheapen costs that saline waters can be purified for use for irrigation of those vast areas throughout the world.

The chemical industry provides a further vast potential field for electrodialysis, wherever dilute solutions require concentration before economic chemical treatment is feasible.



USING QUEBEC specular hematite crushed to minus 20 mesh and air classified to 200 mesh, Carpco Manufacturing, Inc. found that the iron ore can be dry concentrated on high-tension separators to 65% iron at better than 90% total iron recovery.

Dry Concentration of Iron Ore

WITH TWO RECENT DEVELOPMENTS, dry concentration of iron ore, both magnetic and non-magnetic, comes nearer to reality. First, Carpco Manufacturing, Inc., Jacksonville, Fla., announced that they have developed a high-tension electrostatic separation technique. Second, Ontario Research Foundation reported that both a dry magnetic process and a special cone pelletizer for dry feed have been developed.

Speaking at the joint AIME and Southern Conference, William P. Dyrenforth, manager of sales, Carpco Manufacturing, Inc., explained his company's research work on the High-Tension Process. A technique has been developed that now needs only pilot plant or semi-works study—a method that can produce a 65% Fe concentrate with better than 90% iron recovery. In fact, in some cases a 68% Fe on 95% recovery has been obtained in test conditions.

Using Quebec specular hematite crushed to minus 20 mesh and dry classified to 200 mesh, Carpco engineers produced two concentrates (a plus and a minus-200 mesh) with a total 97.5% iron recovery.

Ore was 38% Fe and the feed rate ½ long ton per hour per foot of rotor length. Preliminary results showed that less than five feet of rotor length are needed to handle one long ton per hour feed. Further testing followed and produced these results.

Carpco found that magnetite, martite and hematite minerals react in an identical manner under high-tension statics. When they occur together, all three can be recovered by one simple, inexpensive process. In present-day taconite projects, only the magnetic taconite is recovered. Furthermore, the most common gangue element in the ores tested by Carpco is silica—a good insulator or dielectric, which makes it easier to complete the separation of mineral and gangue.

In his paper Mr. Dyrenforth went on to say, "High-Tension Process as applied to iron is not nearly as high in cost as we would tend to believe . . .Most of us have been led to believe that the so-called electrostatic method of beneficiation was a complicated and expensive process."

He offered this cost estimate on the high-tension step.

To treat one long ton per hour of iron ore in a minimum plant of 5,000 tpd feed, using 5 ft of rotor length per ton of feed—

Maintenance (labor and materials at 0.274c/ rotor ft/hr)	1.534c
Power cost at 1c/kwh	0.234c
Labor at $5,000/man-year	2.286c
Total	4.054c

With higher recoveries and higher grades than possible from most wet processes, Carpco says that High-Tension Process offers one additional important advantage over current techniques. Process does not require water, since the material must be surface dry to get a good separation. In the great iron fields of northern Canada, water is hard to get, being frozen solid most of the year. Carpco points out that the problem is a serious handicap to any iron mining venture in this area. With a dry process, the water problem is solved.

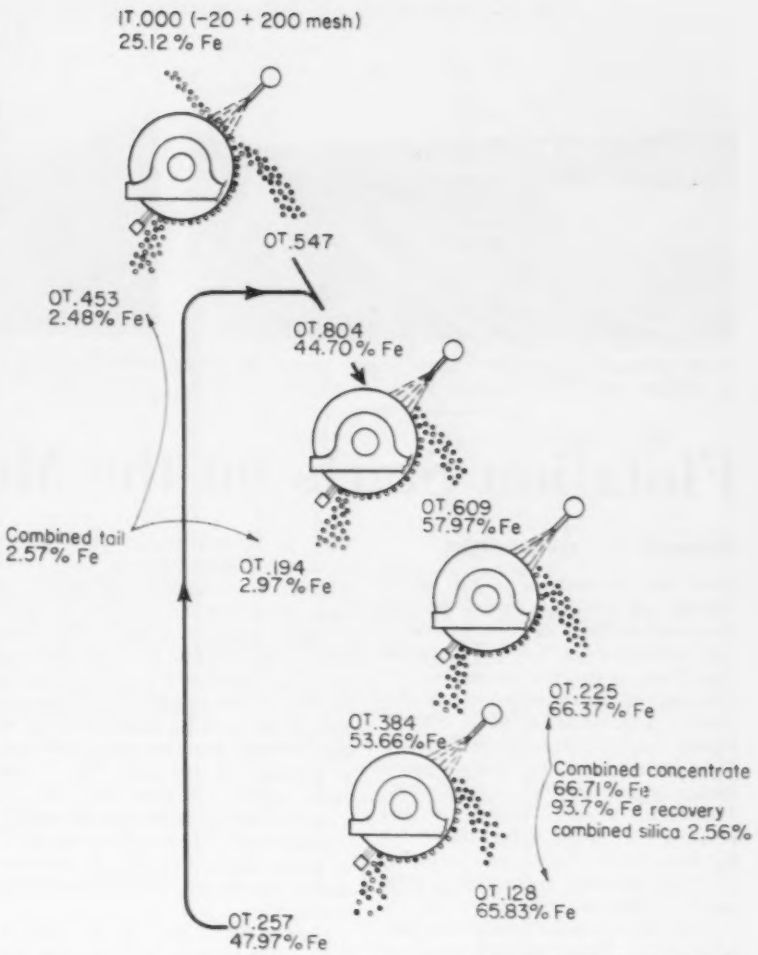
Capital costs of a High-Tension Process may be higher than that of a wet process of same capacity, but Carpco says that the very low operating costs, as shown above, makes the process worthy of consideration, and substantiates Mr. Dyrenforth's point that the idea that it is highly expensive is "not entirely true."

Second and equally startling development comes from the Ontario Research Foundation. According to P. E. Cavanagh, director, department of engineering and metallurgy, ORF, in the *Canadian Mining & Metallurgical Bulletin* for November, the foundation has devised a cone-shaped, high-capacity pelletizing cone especially for handling dry concentrates. ORF also has established a dry magnetic concentration process and attending equipment, but the pelletizer is the key item.

Mr. Cavanagh says that two-thirds of a dry magnetic concentrate is mixed with an excess of water to a total 18% moisture, pugged, then extruded through a 1-in. dia die, and cut to 1 in. long wet slugs. These slugs fall directly into the pelletizing cone as shown in the drawing. A rotating cone fits inside a stationary hood, with an adjustable space between the two. Slugs are rolled around the space between the cones to form balls as they descend, much in the manner in which billiard balls are formed.

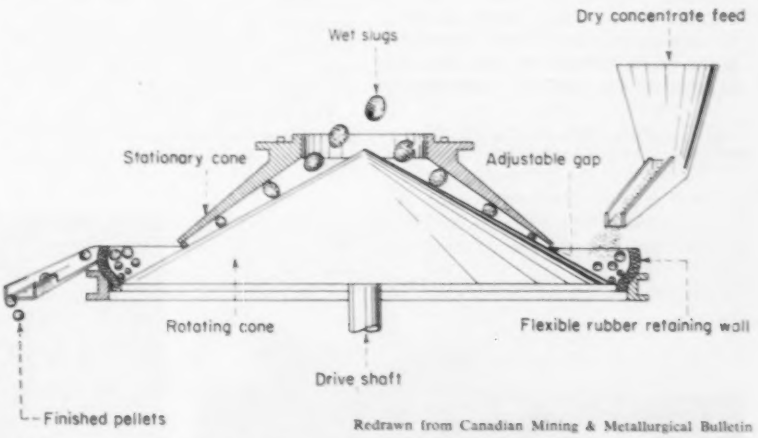
On emerging from the pelletizing cone, pellets are whirled and bounced around a rubber covered rim to bring the excess moisture to the surface. The remaining one-third of the dry feed, plus any additive desired is added in the rim. The gap between the pelletizing cones determines the minimum pellet diameter. Here, on the rim, the amount of excess moisture limits the amount of dry iron concentrate that the pellet can pick up, limiting the maximum pellet diameter. Final moisture content of the pellets as they leave the machines ranges from 7 to 12%, sufficient for good green strength.

Foundation engineers believe that the extrusion-pelletizing method will offer a high capacity device that eliminates many of the bottlenecks that have discouraged dry concentration and the pelletizing of the dry product.



Courtesy Carpco Manufacturing, Inc.

HIGH-TENSION PROCESS data is based on one-half long ton per hour per foot of rotor. Both magnetic and nonmagnetic iron are recovered in one machine.



Redrawn from Canadian Mining & Metallurgical Bulletin

CONE PELLITIZER was engineered by Ontario Research Foundation to treat dry iron ore concentrate produced by their dry magnetic concentrating method.

FEED to plant comes from electric suction dredge operating on adjacent old "wash" tailings pond and digging to 50 ft.

SHIPPING BIN has dewatering rake classifier and filter mounted overhead. Thus only hydraulic conveying need be used.

Flotation Starts on the Mesabi

RICHARD W. LIVINGSTON

IRON ORE FLOTATION is the major feature of the Hill Annex Tailings Reclamation Plant at Calumet, Minn. This operation of Jones & Laughlin Steel Corp. is the first commercial application of froth flotation on the Mesabi iron range. A spiral concentrating section precedes the flotation. Flotation started in July but the spiral section began operating in May 1957.

Another unusual feature of the plant is the use of a suction dredge for low-cost excavation and transport of feed material from old tailings pond to mill site. (See photo above.)

Two construction features are also noteworthy. First, the efficiency of hydraulic transport is retained right to the shipping bin by having the final dewatering classifier and filter mounted directly over the bin in the loading tower. (See photo above.) No belt conveyors are used anywhere in the plant. Second, the mill building is designed for easy, low-cost expansion in several stages (see photos below and floor plan on pp 92-93) without a corresponding penalty in high initial cost.

Mr. Livingston is chief ore dressing engineer, Minnesota Ore division, Jones & Laughlin Steel Corp., Virginia, Minn.

Plant capacity is now 136 long tons (solids) per hr of crude feed and output is about 100 lt (solids) per hr of 60% Fe (dry) concentrate. Expansion plans to bring production up to 200,000 tons per year entail additional flotation circuits only. This is because leaner and finer feed will be handled. Current flow, in which spirals (coarser material) handle about 90% of feed, may be completely reversed so that flotation (finer material) will handle 90%.

Feed to plant comes from adjacent pond which contains tailings from old "wash" plant operated by Interstate Iron Co. (now absorbed by J&L) from 1920 to 1950. Of total in pond, about 6-million long tons are estimated amenable to treatment. New plant is sited near old tailings discharge point, since undesirable slimes generally travelled to far reaches.

Pre-planning sampling by 6-in. auger mounted on crawler with casing pulled by crawler-mounted churn drill rig, also showed that rich grades overran lean grades going away from old discharge point. Contaminated 5-ft bottom in 55-ft deep (maximum) pond will not be dredged.

This old "wash" tailing consists of fines removed from mine-run ore by simple washing. In "wash" ore—typical analysis, 42% Fe—making up most western Mesabi orebodies, silica occurs mainly as fine sand and hematite as coarser size. Although today's wash tails are typically only 25% Fe, their iron content does vary and older tails, especially, may be higher.

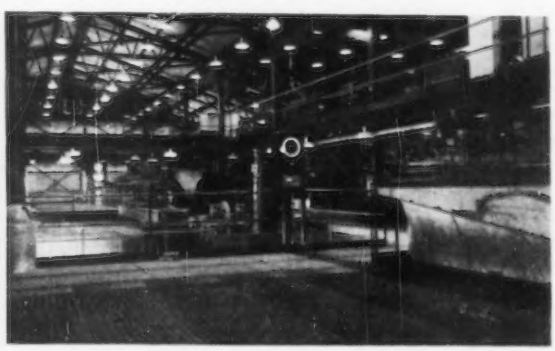
Dredge started at 7 ft, is now at about 25 ft and will reach 50 ft. Floating 10-in. pipeline will eventually stretch to 2200 ft.

Process, detailed in flowsheet, was developed by J&L, and mill design and construction was by Western-Knapp Engineering Co.

Flotation conditioning is critical. Flotation is not very effective unless conditioning is at high density. Retention time and method — 6 minutes in drum—must prevent "painty" (shaly) fraction from sliming.

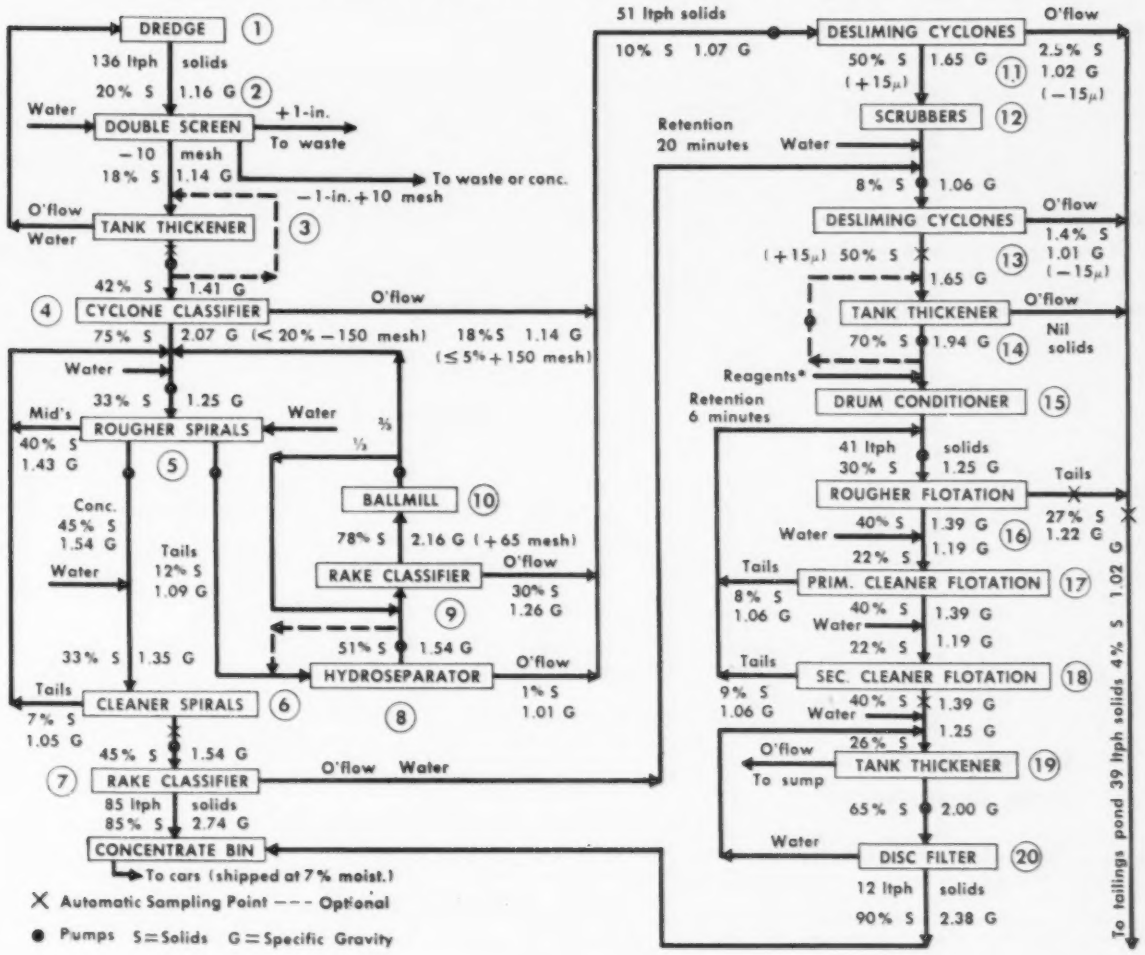
To aid processing control, there are

MILL BUILDING has unusual exterior because plans call for easy expansion of flotation section in several stages.



INTERIOR is uncluttered, with self-cleaning grating for upper floors. Flotation cells are at right; spirals, beyond.

Hill Annex Tailings Reclamation Plant, Calumet, Minn.



LEGEND

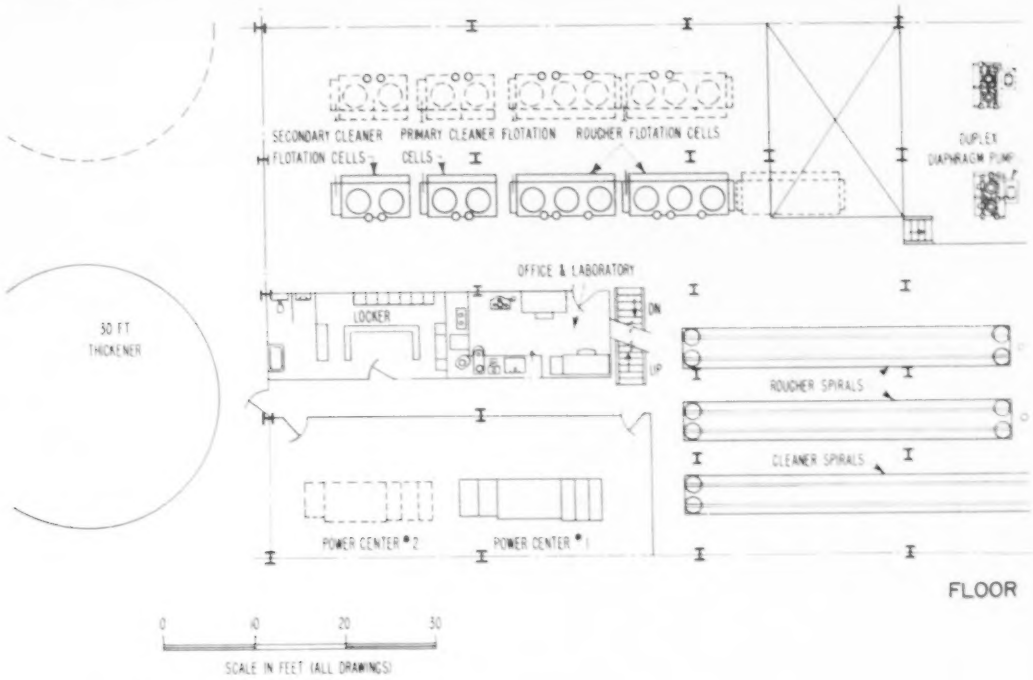
*Reagents: Petroleum sulfonate, 3.0 lb per lt, fed by piston pump; fuel oil, 3.4 lb per lt, fed as above; H_2SO_4, 3.0 lb per lt, fed by Pulsafeeder.

1. Electric suction dredge: 30-in. revolving cutter head, 10-in. (eventually 14-in.) discharge centrifugal pump, 350hp.
2. Double deck screen: one 6x14 (outside building)
3. Thickener: one 70-ft dia (outside building)
   (pumps: one 8x6 CWG & one 10x8 CKG)
4. Cyclone classifier: one 24-in.
   (sump pump: one 10x8 CWG)
5. Rougher spirals: 128 5-turn
   (pump: two 8x6 CWG)
6. Cleaner spirals: 75 5-turn
   (pump: one 8x6 CWG)
7. Dewatering rake classifier: one 6x26—(mounted over RR loading bin)
8. Hydroseparator: one 24-ft
   (pump: one 6-in. triflex diaphragm)
9. Rake classifier: one 4x34
10. Ball mill: one 8x9
    (pump: one 2-in.)
    (cyclone feed pump: one 10x8 CWG)
11. Desliming cyclones: nine 10-in. cylindrical & 4-in. conical combination, rubber-lined
12. Scrubbers: 2 banks of four 66x66-in. with swirl baffles to prevent vortexing, modified Fagergren rotor without stator, 20hp each cell
    (pump: one 8x6 CWG)
13. Desliming cyclones: 8 as at 12.
14. Thickener: 30-ft dia
    (pump: 6-in. duplex diaphragm)
    (optional bypass pump: 2-in.)
15. Drum conditioner: one 6x16 black iron
    (pump: one 5x5 NRL rubberlined)
16. Rougher flotation: 2 banks of three 43x43-in. Type M stainless steel
17. Primary cleaner flotation: two 43x43-in. Sub A
18. Secondary cleaner flotation: two 43-43-in. Sub A
19. Thickener: 30-ft dia
    (pump: one 5x4 CWH)
20. Filter: 7 disc (using only 2 now) with wet type vacuum pump (over bin)

seven points in the circuit where pulp samples are automatically taken at selected time intervals. Of particular interest is a pulp density meter on dredge pump discharge. It is a gamma-ray type giving direct reading in percent solids by weight. Simplicity of installation and maintenance plus accuracy is superior to other known schemes.

Reagent feeding is centrally done from separate house. Steam generator heats cars and tanks of sulfonate, and electric heater is used for fuel tanks.

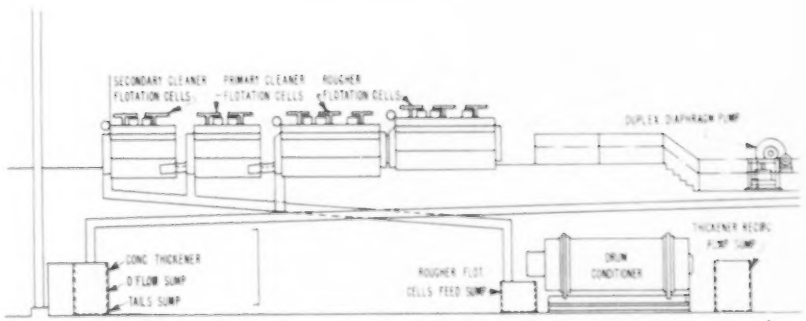
Permission of Jones & Laughlin Steel Corp. to publish this article is gratefully acknowledged by the author and *E&MJ*. (Plant drawings follow.)

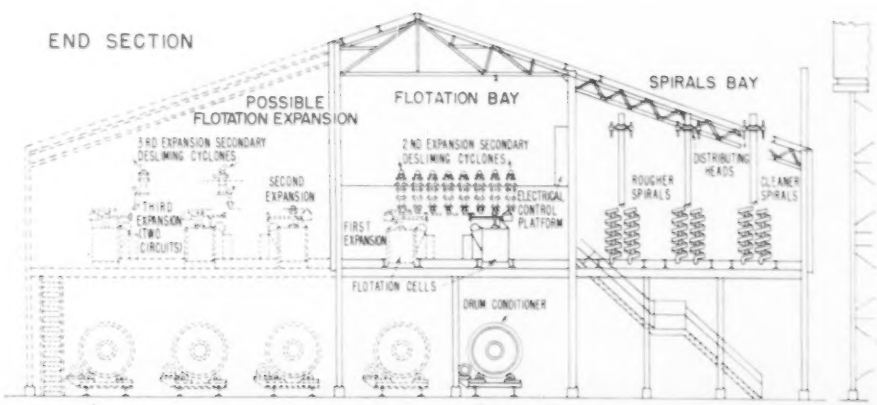


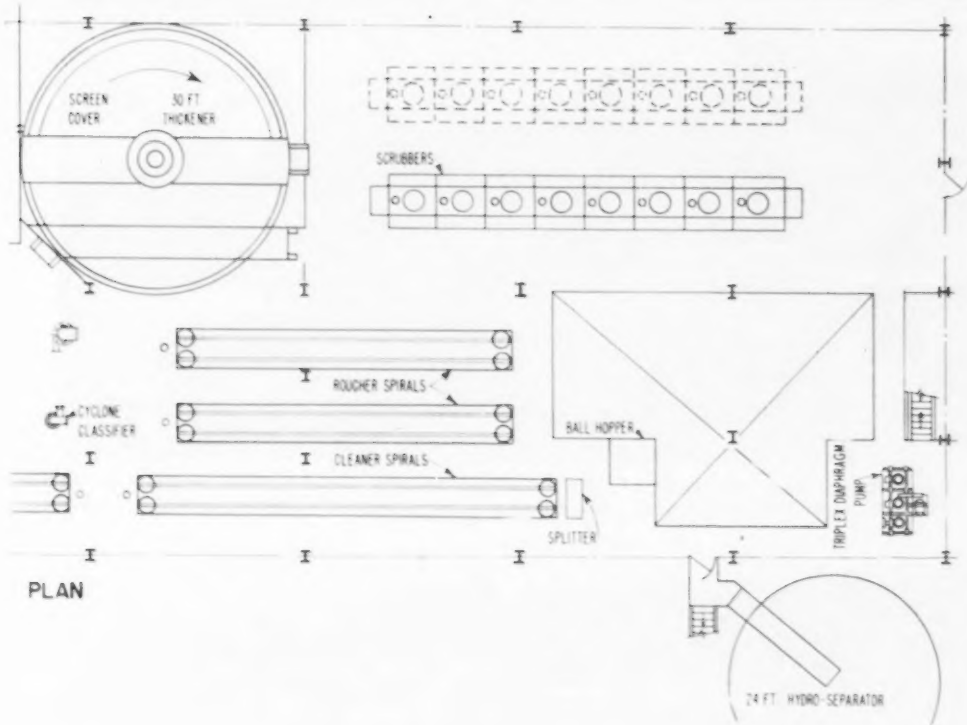
Design Is Simple And Uncluttered

EQUIPMENT has been arranged with idea of easy access and expansion, as well as orderly flow. End section (below) shows reason for unbalanced appearance of building—ease of expansion. Heavy machinery is located on lower level, as are the bulk of the pumps. Upper levels are floored with grating.

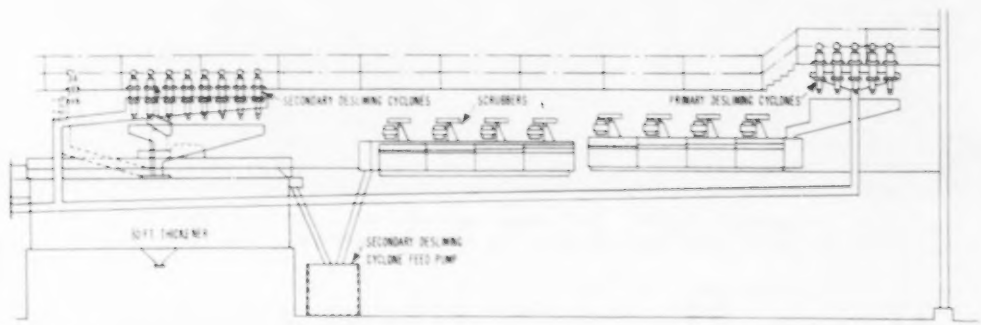
Feed to plant comes from dredge on pond, off to upper right in plan. Double-deck screen and 70-ft dia tank thickener are adjacent to building, off right in plan. Process flow is toward left, in general, and shipping bin is off to lower left in plan.



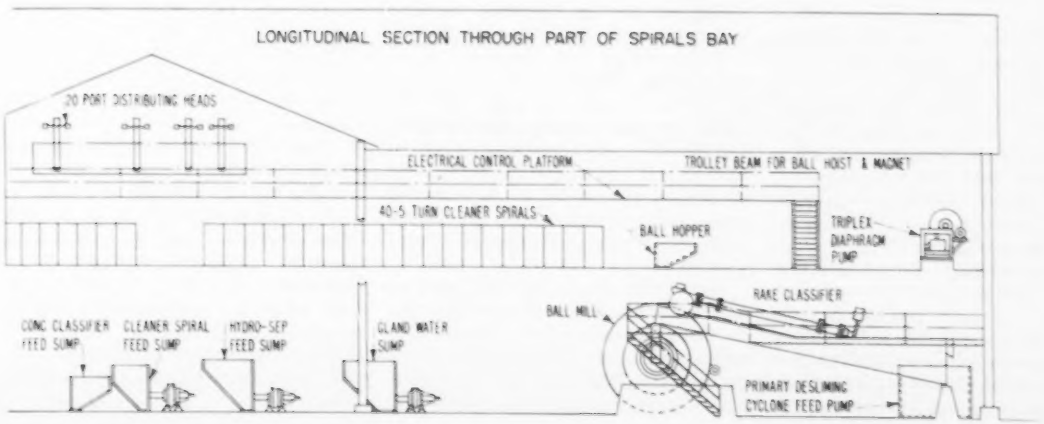




PLAN



FLOTATION BAY



HANOVER MILL of Metal & Thermit Corp. was designed by Knowles Associates, New York, to produce 5,000 tons of rutile concentrate annually, plus ilmenite, from Hanover, Va. beach sand deposit. Wet and dry mill are shown at the left.

TWO CATERPILLAR tractors and bowl-scrapers dig the titanium-bearing sands to a maximum depth of 18 ft. Ore runs 2.5% heavy minerals with values split 50-50 rutile and ilmenite. Ore is first concentrated on Humphreys Spirals.

Virginia Heavy Minerals Plant Opens

METAL & THERMIT CORP., New York, N. Y., has re-entered the domestic rutile and ilmenite supply market, opening a new 100-tph mill mine in Hanover County, Va.

Until recent years, the principal use of rutile in the U. S. has been in the coating of arc welding electrodes. According to H. E. Martin, president, "In 1956 nearly 13,000 tons of rutile were consumed in coatings for electrodes. This was more than the total consumption of rutile for all uses five years previously. With arc welding being employed more extensively each year, in such fields as shipbuilding and in the construction of heavy machinery, railroad equipment, bridges and structures of all kinds, we expect that by 1962, consumption of rutile for use in electrode coatings will reach some 20,000 tons annually."

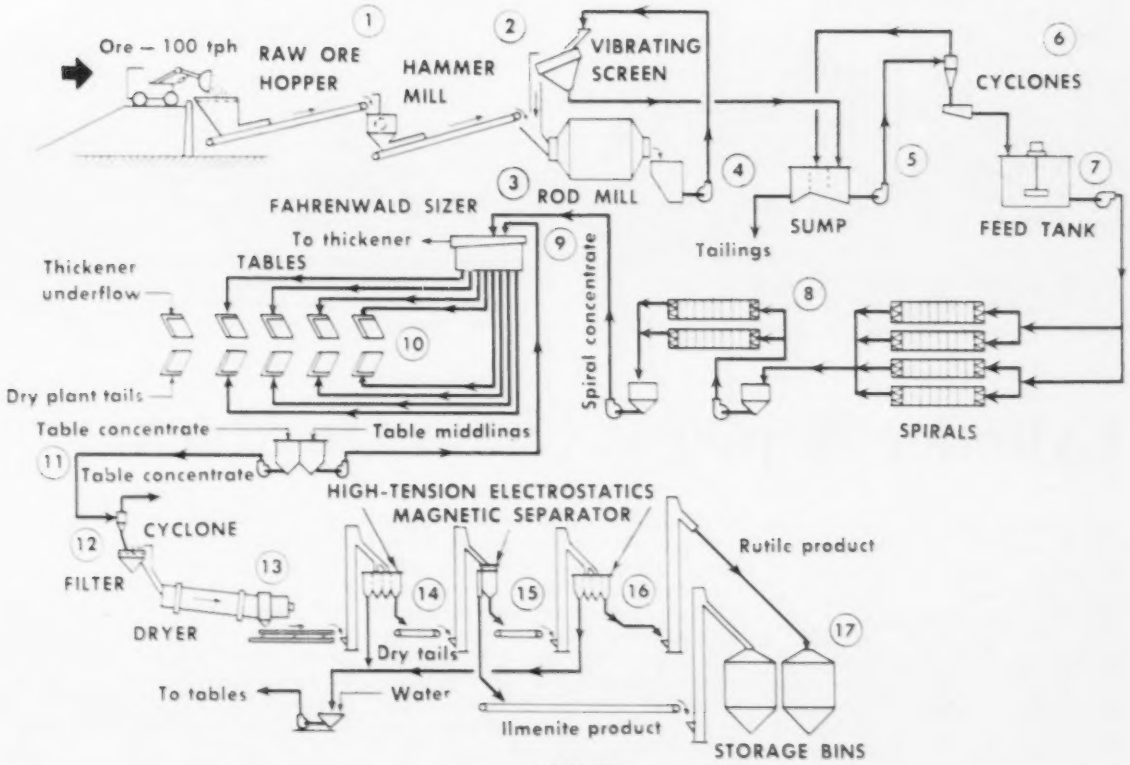
Representing an investment of $1,250,000, M&T's new facility is slated to become an important domestic source of rutile and ilmenite for the company. In 1958, Metal & Thermit's Hanover mill will be capable of supplying 12% of U. S. domestic rutile needs (50,000 tons in 1956), 70% of which is imported from Australia.

New Hanover mine and mill is scheduled to produce some 5,000 tons of rutile annually. Ore reserves are sufficient for 10 to 20 years, depending on industrial demand. Ore runs 2.5% heavy minerals, split 50-50 rutile and ilmenite. The rutile assays about 94% TiO_2, while the ilmenite runs 52 to 53% TiO_2.

Rutile-bearing sands will be strip mined on the 800-acre property to a maximum depth of 18 ft using two Caterpillar tractors and bowl-scrapers. Raw ore is fed into an outdoor hopper which discharges onto a belt conveyor carrying the ore into the wet mill.

Ore is reduced to minus 1 in. in a Pennsylvania hammer mill, and then taken by a second conveyor to a Hardinge rod mill, in closed circuit with a Leahy vibrating screen, where minus 30 mesh grinding is accomplished. Wet cyclones deslime the pulp which is then treated on rougher spirals.

METAL & THERMIT CORP., HANOVER COUNTY, VA., BEACH SAND PLANT



LEGEND

1. Caterpillar Tractor Co. front-end loader delivers to hopper outside wet mill. Ore feeds by conveyor to hammer mill
2. Ore is crushed to minus 1 in. in a Pennsylvania Crusher Div., Bath Iron Works hammer mill, then travels by belt to the rod mill
3. Hardinge Co. rod mill reduces pulp to minus 30 mesh in closed circuit with #4
4. Allen-Sherman-Hoff Pump Co. pump feeds Deister Machine Co. Leahy screen with 30 mesh cloth
5. Slurry feeds to sump, then up to cyclones through a Morris Bros. Machinery Co. pump
6. 14-in. dia wet cyclones deslime ahead of spirals
7. Spiral feed tank with General American Transportation Corp. Turbo-Mixer
8. Humphreys Investment Co. spirals divided into roughers and cleaners. Total of 60 five-turn units are fed by Allen-Sherman-Hoff Pump Co. pumps
9. 8-cell Fahrenwald-type sizer splits heavies to two banks of sand and slime tables. Overflow goes to thickener
10. Deister Machine Co. tables. Sand tables have rubber deck and riffles. Slime tables use wooden riffles
11. Table concentrate goes through a Denver Equipment Co. pump to a cyclone
12. Carpco Manufacturing, Inc. filter dewaters ahead of the dryer
13. Oil-fired 4 x 25 ft Edw. Renneburg & Sons., Co. dryer
14. Shaker conveyor and belt elevator takes dry feed to four Carpco high-tension statics. Tails return to tables. Conductors go to the magnetic separator
15. Magnetic separator cuts out the ilmenite product and sends rutile-bearing nonmagnetic to the rutile static cleaner. Magnet is Stearns Magnetics, Inc.
16. Carpco high-tension statics make final rutile concentrate and return dry tails through a Denver Equipment Co. pump to a table. Bucket elevators are by Carpco
17. Storage bins deliver to truck for shipment to railhead at Ashland, Va. Tailing line sump pump is Morris Machine Works. River and pond water pumps are Worthington. Service water pump is a Gould. Surface run-off pump is a Marlowe

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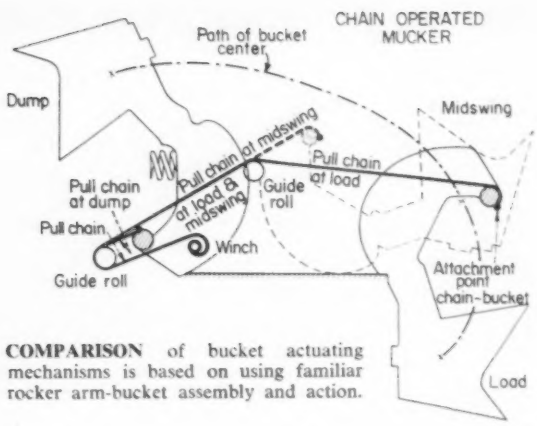
Four banks of 5-turn Humphreys spirals make a rougher concentrate which feeds to two banks of 5-turn cleaners for finishing. Spiral concentrate is pumped to a Fahrenwald-type sizer distributing to Deister sand and slime tables. Eight shaking tables are used on spiral concentrate. Overflow from the Fahrenwald sizer passes to a thickener whose underflow returns to a separate Deister concentrating table for scavenger recovery.

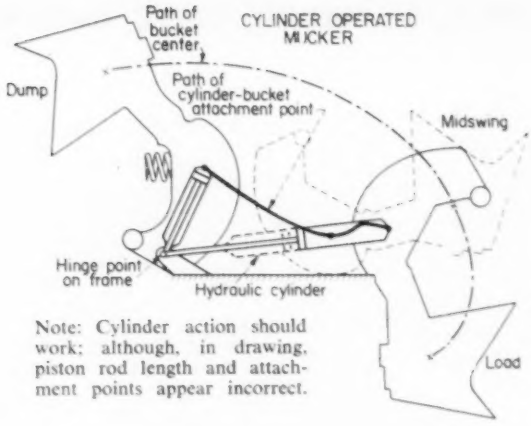
Table concentrate is pumped to a small cyclone, then to a Carpco filter and into the dryer. Dried heavy minerals are fed by bucket elevator to four Carpco high-tension rolls that make a conductor concentrate for the Stearns magnet. Non-conductors from the statics return to a special Deister table after being wet down.

Stearns magnet makes the ilmenite concentrate and sends the rutile-bearing nonmagnetic fraction to four more Carpco high-tension rolls. A final rutile concentrate is made here. Both the rutile and the ilmenite are stored separately in bins from which they pass to trucks that deliver to a railhead at Ashland, Va., just outside Richmond.

Process tailings are pumped to a 20-acre pond and allowed to settle, clear overflow returning for plant use. Additional water is pumped from the South Anna River and piped to the wet mill. No silt or refuse containing water is ever put back into the river—it all goes to the pond.



COMPARISON of bucket actuating mechanisms is based on using familiar rocker arm-bucket assembly and action.



Note: Cylinder action should work; although, in drawing, piston rod length and attachment points appear incorrect.

Cylinder Replaces Chain On Mucker

HYDRAULIC TILTING CYLINDER and electrohydraulic drive for rocker arm loaders is superior to other mechanisms, says Nandor Meitzen in a recent Hungarian publication.

In place of chains or cable, a double-acting hydraulic cylinder actuates bucket lift. Basic rocker arm-bucket assembly and path of motion, as found on familiar overcast shovels, is retained. Hydraulic pump, loader travel and horizontal swing are powered by an electric motor.

In addition to better "regulation of bucket movement," the author cites these advantages:

"From the viewpoint of operational safety, the two devices may be declared equivalent. A hydraulic tilting mechanism can be constructed in a very simple and safe manner.

"The driving electric motor can work under very favorable conditions; it can be started under no-load and can be kept permanently rotating during the process of loading. It is not necessary to stop or reverse the motor for switching for lifting, for moving the machine or for reversing the motion. The electric switchgear, which includes many sources of faults, is thus simplified, and surges in the electric network are also eliminated.

"The electrohydraulic solution offers innumerable facilities of design, which is especially pronounced when small loaders of low projection height have to be designed. It is obvious to design the machine for full hydraulic operation, that is, to operate the running gear and the shovel mechanism of the loader from a common current circuit. Synchrony of the two motions is practically hardly ever possible, so that in rating the new driving motor a power rating hardly exceeding that of one motor of the present two-motor solution has to be provided for.

"Operation of the electric-driven loader is from many viewpoints simpler than that of the compressed air machine. Instead of steel piping of large diameter, only flexible rubber cables are used. The efficiency of power transmission is high; therefore operational costs are lower than those of the compressed air machine. In mines where no percussive air drills are used, the compressed air supply system can be entirely eliminated, and electric drive of loaders is to be preferred, by all means."

Action of Air or Electric Units

Common pneumatic and electromechanical driven units are said to act essentially alike. Rocker arm-bucket assembly forms a single unit. As it rolls back, bucket center describes cycloidal path. In type studied (see drawing, above left), bucket is pulled back by chain which is fastened to and passes around cylindrical lug on arm. Chain then passes over two guide rollers and is fastened to winch drum which is driven through gears by air or electric motor. Since chain reels up over own coils, even at constant rpm, an acceleration develops on chain. Author says acceleration can be approximated as constant because change in radius of winding is small and starts at essentially zero. Also obvious in drawing, is deceleration effect of chain unwinding from stud on arm.

Hodograph (curve showing magnitude and direction of velocity originating from one point as time changes) for bucket is used for further study. Values are found by first computing instantaneous chain speed: $V_L = \frac{r_G n_G}{9.55}$ meters per sec, where r_G is radius of winding in meters and n_G is rpm of winch drum.

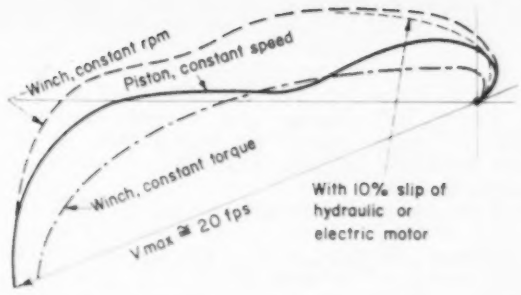
This is developed to give instantaneous velocity for center of bucket, v_S, by using point of contact between arm and frame as instantaneous center of rotation. Shape of curve is said to depend on rpm. Formula is only very briefly treated and as printed appears to have typographic errors: $v_S = \frac{V_L r_G}{r_L}$, where r_L is radius from line of chain to point of arm-frame contact. It probably should be $v_S = \frac{V_L r_S}{r_L}$, where r_S is radius from bucket center to point of arm-frame contact. This resolves into $v_S = \frac{r_G r_S}{9.55 r_L} n_G$. Direction of v_S is perpendicular to r_S.

Constant rpm drives are discussed first. Within certain limits a three-phase electric motor or a hydraulic motor fed by a constant delivery pump satisfies this condition.

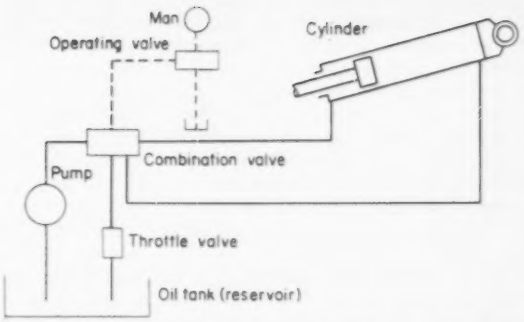
At start of lift, chain is slack and motor is already accelerating. When bucket starts to move it is sudden. With increasing load, slip of electric motor and volumetric loss of hydromotor grows at same rate. Maximum is shown as about 10% in hodograph. But because this greatest increase in load and resulting slip occurs when velocity is low, author says this variation in rpm is "not important."

Swing of bucket immediately after initial lift from side to center should be as smooth as possible. Therefore low bucket speed is desirable and, author continues, this factor is unfavorable with constant rpm.

Constant torque drives are discussed next. This is the case of a



BUCKET VELOCITY is of major interest. This hodograph pictures magnitude and direction of instantaneous velocity of bucket center at various times during bucket movement.



HYDRAULIC SYSTEM for throwing bucket is designed to reduce starting shock, to give sensitive control and to make thrust control independent of bucket speed. Valves are key.

compressed air piston motor or a hydraulic motor of constant delivery fed by a variable discharge pump.

Shape of hodograph for this case depends on more involved variables. Acceleration of bucket center, a_s, depends on pull of chain and geometry, but also on mass of arm-bucket and load, as well as position of center of gravity. Curve shown is based on: assuming that mass of loaded arm-bucket is concentrated at bucket center and total weight, W, is 300 kg; and moment of drum torque, M_G, is selected so final velocity is about equal to that for constant rpm drive and direct comparison is possible.

Values come from equation of moments about point of arm-frame contact:

$$\frac{M_G}{r_G} r_L = \left[(W \cos b)\, r_s \right] + \left[\frac{W}{g} r^2_s\, a_s \right]$$

where b is inclination of r_s above frame, g is apparently acceleration of gravity and other factors are as defined above. (Author says moments about bucket center, rather than about arm-frame contact. And original equation is printed with minus sign between two expressions on right rather than a plus sign.) "The left hand expression is moment of chain pull, balanced [on right] by sum of the moments of the weight and of inertia. From the formula of the moment of inertia the angular acceleration can be determined. From the tangential acceleration computed from angular acceleration, velocity vectors [of bucket center] have been determined by graphical integration."

If air and electric shovels are compared, "it becomes at once evident curve obtained for the compressed air engine has a much more favorable shape: the speed of lift and of the section following it is quite low; swinging in of the shovel into the center is more hitchless; and at the low lifting speed the operator can much more favorably produce the slight digging-in shaking motion so necessary for picking up large lumps."

"The well and quickly reversible air motor has another great advantage in driving the travel motion of loader when digging. The electric loader could not even approach the slight forward-backward moves required in picking up. Run out of motor was always more than operator wanted."

"Observation of the last section of swinging back shows that acceleration in pneumatic drive is much higher than in electric drive. This makes possible better control of the distance of slinging. The operator better feels when to shut off the engine for "rougher" or "smoother" throwing back of the muck. This is the condition of uniform filling of mine cars.

"If the period of lifting is investigated as regards possibility of control, it is found that the deviation of the theoretical hodograph curve is of no great practical importance [because it] is only necessary that the operator be able to reduce the speed of lifting at will. It is especially desirable to control [horizontal rotation] without jerking."

Features of Hydraulic Units

If hydraulic shovels are considered, author implies certain advantages and goes on to note:

When rotary hydro motor is used "the present mechanism can be retained intact. Two methods of control are possible: combination of a pump of variable discharge and of a motor of constant delivery, or the use of variable discharge hydro machines in both units. In the first solution the condition of constant torque is satisfied by controlling the discharge of the pump by means of a governor keeping pressure constant. Since the torque of a constant delivery motor depends on pressure only, this method of control can produce the hodograph curve of the pneumatic drive.

The same could be attained by the use of a constant discharge pump and of a reducing valve; there is a great difference in the efficiency of the two solutions. From the viewpoint of energy transmission, another method would be the most favorable one: combination of variable discharge pump and motor so that the power input be kept constant. However, this method involves the greatest possibility of failure, and would not present appreciably more advantage in proportion to that.

"The use of a rotary hydro moto. presents great difficulty from the viewpoint of design. Space demand of the pump unit and of the oil tank is satisfied with difficulty because of reduced dimensions of the machine."

But a pulling cylinder with a simple electrohydraulic drive attains very favorable kinematic conditions, continues the author. With such design, a very reliable device—a hydraulic cylinder—is substituted for the most delicate element of the machine—the chain.

In this case, cylinder is fed by constant delivery pump and speed of piston, v_H, is constant. Bucket velocity is: $v_s = \frac{r_s}{r_H} v_H$, where r_H is radius from line of cylinder to point of arm-frame contact. (In paper, r_s actually appeared as r_H.) Final v_s is set equal to that for previously studied drives so hodographs are directly comparable.

"As evident from the figure, the hodograph of the hydraulic system is very favorable. Along the full stretch of motion it represents an intermediate state between hodographs of the electric and of the pneumatic systems, but of particular advantage is the short acceleration period on the middle section of motion, which just falls to the period of swinging the shovel into middle position.

"The starting section of the hydrau-

lic dumping mechanism depends on the rate of speeding up the motion of the hydraulic cylinder to constant speed. The period is fixed by the time of reversal of the hydraulic control. It is of utmost importance that this period of reversal be not too short. Though the hodograph shows that acceleration is fairly moderate, because of the large mass of the shovel the starting shock has to be reduced very much. Since in conventional design the pulling chain can exert pull only, slinging cannot be controlled by braking the driving motor and regulation is attained only by the counter-torque of the shovel and the ratio of reduction of the chain pull. Since the hydraulic cylinder produces, besides pull, thrust as well, a greater counter-moment can be given to the shovel than before. This extends greatly possibilities of control.

"On all three hodograph curves the maximum shovel speed is about 6 m/sec. This projects the material to a very great distance but good filling of mine cars requires this speed to be reduced, even to half value. It can be reduced better by developing counter torque. This is especially important because at swinging back, and along the short stretch before it, the counter torque arising from the weight of the shovel is small. However, the thrust of the hydraulic cylinder has to be limited to prevent the rocker arm of the shovel from lifting itself from the path. Factors here mentioned basically affect the design of the hydraulic control equipment:

"Loaders with pneumatic and electromechanical drive have two driving motors. Hydraulic solution of tilting makes one motor superfluous. Hydraulic pump of the tilting mechanism will be driven by the propulsion motor on the underframe, which drives the trailing axle of the loader. Since the hydraulic pump always rotates in one direction, the trailing axle and the pump will be driven through the intermediate of a gearbox. The electric motor will not drive the trailing axle directly, but over a jackshaft and a reversing clutch. The motor can rotate in one sense and drive the pump by an intermediate gear.

From the viewpoint of electric drive, this solution is very advantageous. No-load starting of the electric motor is possible, and the motor can be kept rotating during loading. The electric outfit of the loader becomes very simple and there is no need of switchgear on the loader. Starting and stopping of the electric motor can be executed by remote control. Idle run of the hydraulic pump can be assured by using the safety valve as an unloading valve. Forward and reverse run of the trailing axles, or their stopping is effected by the reversing clutch."

Hydraulic system is designed to reduce starting shock, give sensitive thrust control and have thrust control independent of speed. Combination valve (see drawing) is regulated by operator, through operating valve, and has two principal settings: bucket lift back, when fluid from pump is admitted to piston-rod end of cylinder; and bucket "sinking," when fluid is admitted to both sides of piston and at the same time passes through throttle valve to tank. Throttle valve is set to keep low pressure in system. Surface of piston facing bucket end of cylinder has larger area. Thus, differential pressure aids the usual simple gravity and bumper spring effects in returning bucket to digging position. Shovel can be stopped in any position and it can be shaken. Thus, there is positive control at all times.

Hungary Prints Research Annual

PRECEDING ARTICLE is based on "Electrohydraulic Drive for Shovel Loaders"—appearing, in English, in *Publications of the Hungarian Research Institute for Mining, Number 1—1957*. In the foreword dated June 11 in Budapest, Zoltan Ajtay, director, invites comments and says:

"During its activities of nearly seven years the Mining Research Institute has largely contributed to the theoretical development of the mining industry.

"Within this period the co-workers of our Institute have published a great number of papers in the Hungarian, Russian, English, German and French languages: partly in *Acta Technica*, edited by the Hungarian Academy of Sciences, partly in the Hungarian technical press as: *Bányászati Lapok* (Hungarian Journal of Mining), *Kohászati Lapok* (Hungarian Journal of Metallurgy), *Magyar Kémikusok Lapja* (Journal of the Hungarian Chemical Society), *Magyar Kémiai Folyoirat* (Hungarian Journal of Chemistry), *Elektrotechnika* (Electrotechnique), *Hidrológiai Közlöny* (Bulletin of the Hydrological Society).

"Thus far, we have been short of facilities for publishing an annual volume that would systematically account for the activities of our Institute in order to keep contact with foreign institutes and enter into exchange relations with them. For this purpose we are now editing this periodical intended to be published yearly. It aims at giving account, at regular intervals, of the most significant results obtained by the co-workers of this Institute. . . . [and reflects] . . . work in course in every section of scientific and industrial . . . [fields of mining research].

Of interest to *E&MJ* readers are the following articles: (E indicates English text; G, German; R, Russian; with abstracts in other two languages).

Preventing Loss of Drilling Mud—R. Ferenc (E): A review of means—primarily American—for preventing loss of circulating medium in drilling for oil.

Continuous Miners For Drifting—Z. Ajtay (G): A Hungarian (F-4), a Russian (PK-3) and an American (Lee-Norse) single head cutter-loaders are compared as to power consumption, size product and physical properties of coal being mined. Tester and method for determining "cuttability" of coals is given.

Mud Stowing—P. Ajkay (R): Blasting speeded drainage of fill in hydraulic filling tests at Jokai colliery. Fill was "local loess" (33% minus 20μ) which had been deslimed in hydrocyclone to cut compaction under 142 psi load from 20% to 8%.

Saving Timber With Steel Props—F. Kummer (R): Two mechanically advancing and two yielding steel props of eastern European design are described.

Caving of Rigid Roof—V. Stubnya (E): Up-dip retreat of coal planer longwall face aided caving (needed to reduce face pressure bursts) of strong roof better than retreating in strike or down-dip directions. Fastest advance of longest face helped, too. Even so, inducing caving by blasting roof is usually needed. Water injection was not much help in their local rock. Props (needed to support immediate working area) should not be set too early.

Computing Surface Subsidence—F. Martos (G): Equation derived from Litwinisyn's (of Mining Academy of Kracow) subsidence formula was verified within ±5% by field measurements.

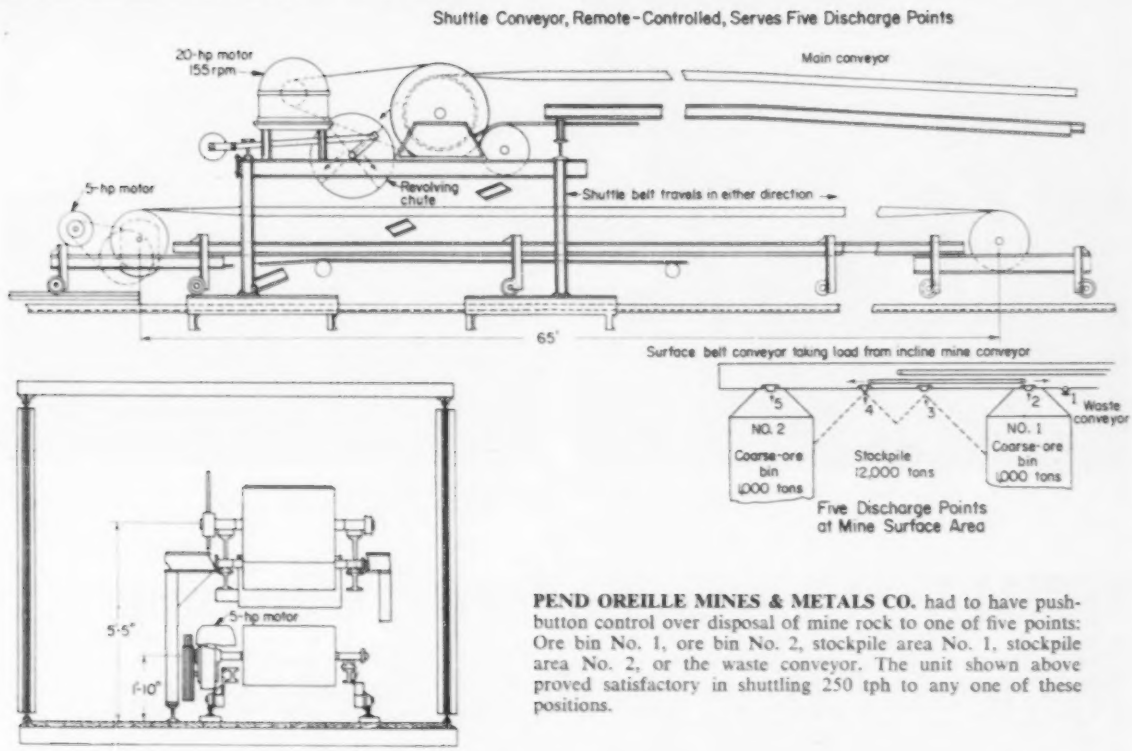
Hydrology of Tatabanya Lignite Field—F. Vigh (G): Hydrological conditions and means of preventing mine flooding, including safety precautions, cementation methods and methods of lowering water table, are described.

Lighting Measurements—K. Halmos & J. Palagyi (E): By including a scaled light source and reflecting plates in a photo of a working place, the visual working conditions can be objectively measured. (Contrasts of brightness and color between object and background, as well as intensity of illumination, determine goodness of visibility.)

Pyrite Mill Uses Hydrocyclones and Flotation—A. Halasz (G): Pyrite occurring in clay vein at footwall of primary pyrite stock in dolomitic and sideritic rocks is concentrated in battery of 7 cm dia cyclones. Ore from stock is concentrated by flotation.

Other papers included in publication were: Dry and Wet Coal Preparation in Hungary—K. Martiny (G); Elution Chromatography of Natural Gas—J. Toth & L. Graf (G); Characteristics of Hungarian Bentonites—J. Barna (E); Peptization Of Clays—J. Barna (E); Changes In Kaolinites During Baking—Z. Juhasz (E); Classifying Mines By Inflammability Hazard—G. Bubics (R); Behavior of Hungarian Lignite Ashes in Sintering—E. Gal (G).

A list of earlier-published "important" Hungarian papers is last chapter.



PEND OREILLE MINES & METALS CO. had to have push-button control over disposal of mine rock to one of five points: Ore bin No. 1, ore bin No. 2, stockpile area No. 1, stockpile area No. 2, or the waste conveyor. The unit shown above proved satisfactory in shuttling 250 tph to any one of these positions.

Remote-Controlled Shuttle Conveyor Serves Five Discharge Points

AT THE LEAD-ZINC PROPERTY of Pend Oreille Mines & Metals Co., Metaline Falls, Wash., ore from underground primary crushing plants is transported to coarse-ore storage facilities ahead of the secondary crushing plant and fine-ore storage at the 2400-tpd concentrator by a train of 30-in. conveyor belts remote-controlled from a central control station on the surface.

The main underground slope system currently consists of three belt sections, each served by a large jaw crusher set to give a 3-in. product and appropriate storage and belt loading facilities. Slope length of No. 1 belt is 1425 ft and incline 17 deg, and that for No. 2 and No. 3 belt is 1815 ft and 10 deg, and 515 ft and 12 deg, respectively. Belts have a capacity of 350 tph, with No. 1 conveyor operating at 450 fpm, No. 2 at 505 fpm, and No. 3 at 415 fpm. All belts underground and on the surface are interlocked and must be started from top to bottom. The underground belt system will ultimately comprise five belt sections.

Load from No. 1 belt is transferred at the portal of the mine incline to a 30-in. belt conveyor leading to the coarse-ore storage plant consisting of two 1,000-ton circular, concrete storage bins and stockpile area between them capable of holding some 12,000 tons of ore. With a belt conveyor installed at the end of No. 2 storage bin to handle waste brought out periodically from the mine, the load from the main surface belt conveyor has to be distributed to five individual discharge point storage bins, two points above stockpile area, and waste conveyor. This presented somewhat of a problem, for to do the job effectively a shuttle belt designed to operate in either direction and movable and remote-controlled was required.

Accordingly, the unit shown was designed and installed. It has given satisfactory and dependable service in every respect. The complete installation consists of a 30-in. by 65-ft belt mounted on a carriage of steel construction and equipped with wheels operating on rails, and a revolving feed chute at the discharge end of the main surface conveyor. Capacity of the shuttle belt is 275 tph and speed is 50 fpm. The main surface conveyor mentioned operates at 350 fpm. Power for the shuttle belt is provided by a 5hp motor. The belt is cut into the general interlocking system, safeguarding the train of conveyors operating between mine and concentrator, and positioned at desired discharge points by solenoid stop controls at the central surface control station. One man can operate the entire conveyor system.

An unusually mobile ensemble of underground mining equipment provides ore for the crushers feeding the belt. Units include 10-ton Dart trucks, 8-ton Oremasters, Michigan 175 loaders, Eimco 105 and 630 loaders, and 2- and 4-machine Hydrojib drill jumbos.

E. K. BARNES, new president of NWMA, talks to convention speaker J. A. Herdlick of U. S. Bureau of Mines (right).

R. R. McNAUGHTON, of COMINO, discusses current lead-zinc situation with Jens Jensen of Pend Oreille Mines (right).

NWMA Stresses Modern Technology, Reviews Cause of Metal Price Drop

REGISTRATION TOPPED 600 at the Northwest Mining Association meeting in Spokane, Dec. 6 and 7. Chief concern of those who attended was the present depressed state of the nonferrous metal mining industry in the Northwest. Resolutions and individual opinion expressed at the convention blamed the current depressed metal prices on excessive imports. But opinion was diversified as to specific remedy. Tariffs received widest endorsement.

Spotlight on Tariffs

A report on the current lead-zinc situation by C. E. Schwab, chairman of the Emergency Lead-Zinc Committee, stimulated considerable convention reaction. Schwab outlined the testimony at the recent Tariff hearings in Washington which induced the Committee to ask not only for tariffs, but import quotas as well. He said that production figures were now available showing that mine output of lead per month in the U. S. had declined 20% during the period from April 1957, when prices were still up, to September 1957. Zinc mine output slumped 30% during the same period.

Maximum duties which can be levied under existing law are 2.10c per lb for slab zinc and 2.55c per lb for lead. These, Schwab said, were inadequate. He estimated that a duty of at least 5c per lb would have to be applied on each metal to bring prices to an economic production level of 17c for lead and 14½c for zinc. Consequently, the Emergency Lead-Zinc Committee has asked for quotas as well. The Committee has made an extensive study of quota systems for other industries. Objectives of a good quota system, he said, should provide for "as much arithmetic and as little discretionary power as possible." Studies indicated that a quarter-quota system would be most workable, in which the accumulation of metal stocks in the hands of producers would signal the need for application.

Formal opinion of the convention on this subject was embodied in the resolutions which endorsed the following recent policy recommendations of the American Mining Congress:

"That as to those metals and minerals in which the United States produces a substantial portion of our domestic requirements, adequate import taxes be established, to be imposed and collected only if and when the average monthly price falls below a reasonable prescribed point legislated for each metal and mineral respectively; thus providing a market free of any duty for foreign imports so long as the average monthly price is at or above the prescribed point."

"When the enactment or application of adequate import taxes and tariffs is not feasible, or otherwise fails to do what is necessary to protect the domestic mining industry, we recommend that import quotas be provided in cases where such device is practical."

Interviews with mining men at the meeting showed a wide range of opinion on tariffs and quotas because of the varied interests of the individuals, and more particularly of the companies whom they represented. One company executive said that there would be no need for anything other than a tariff on metal. He said that the nature of the metal industry was such that import duties of metal in concentrates would be unnecessary and that companies importing concentrates for smelting would automatically adjust the purchase of concentrates to stem weakening markets. Others representing companies operating in both the U. S. and foreign fields suggested a conservative approach to the tariff and quota move, expressing some hope that in the future mining companies would show a little more restraint in production when metal markets showed signs of weakening. At least two well-known mining men at the convention said that if the international mining industry couldn't balance production and demand any better than it has during the past ten years, we would be heading for the same kind of production control that exists

in the domestic oil industry today.

The heavy representation of Canadian mining men at the meeting naturally imposed a certain degree of uneasiness during the discussions on import taxes and quotas. C. E. Schwab handled this deftly by acknowledging that "Canadian producers have kept imports to the U. S. at reasonable levels." In deference to Canadian members of the meeting, Senator Warren G. Magnuson (Dem.), of Washington, expressed confidence that forthcoming talks on reciprocal trade could be "worked out on a friendly and equitable basis."

Running Scared

Sen. Magnuson said that he has been deeply concerned about the serious growth of inflation in the U. S. and during the past 21 years has corresponded with each successive Secretary of the Treasury of the U. S. asking for a statement of position on the gold standard question. He said that in no instance has a single secretary questioned the validity of a gold standard principle, but in each instance fear was expressed of the consequences which would ensue if we dared return to a gold standard. He said that the essence of the replies he received was "that it wouldn't be wise to return to a gold standard because we might have a tiger by the tail." The Senator also reported that the President had ordered the Tariff Commission to speed up its study on the lead-zinc petition so that this issue could be resolved before the consideration of the International Trade Agreements Act comes up next year.

USGS Aids to Exploration

T. B. Nolan, director of the U. S. Geological Survey, tallied up some of the practical and valuable contributions which the Survey has made to recent mineral discoveries. These included the work of Mansfield on the Phosphoria and associated formations of western Wyoming, western Montana and eastern Idaho; work of Josiah Bridge on the lower Paleozoic sedimentary rocks of Tennessee. The former was a major factor in the important recent development of a new and vigorous phosphate industry in the West, and the latter led to the discovery of more zinc ore in the Mascot-Jefferson City district in the past 10 years than has been mined from the northeast Tennessee in its 45 years of mining history.

Other contributions included pioneering work on the application of the airborne magnetometer to exploration; the development of other airborne methods which have speeded up

HOSPITALITY was everywhere. At the coffee bar are (left to right) Mrs. Francis Thompson, Mrs. Lillian Herkenhoff, Mrs. J. A. Herdlick, Mrs. Violette Suchy and Mrs. A. E. Weissenborn. Women registered at the meeting totaled 173.

J. S. McINTOSH of Sheep Creek Mine, British Columbia talks with R. J. Towne (center) secretary of the Northwest Mining Association, and H. E. Doelle (right) also of Sheep Creek.

AT THE DANCE following the annual banquet are (left to right) C. G. Alger, Mrs. S. M. Barton, Mr. Barton, Mrs. A. P. Kelson, Jr., and Mr. Kelson.

E. C. STEPHENS (left) of Anaconda's Spokane office chats with (left to right) Mrs. Frank Marr; Wallace G. Woolf, of the Bunker Hill Co.; Frank Marr, a director of Sheep Creek Mines; and Mrs. Woolf.

CONVENTION SPEAKER, Don Hargrove, of Dawn Mining Co. (center), explains uranium extraction process to Carl Coash, publisher of *E&MJ* (left), during recent field trip to Dawn mill. Paul Stucker, mill foreman (right), joins discussion.

modern exploration such as the airborne scintillometer; geochemical prospecting which is now so widely used in the U. S. and abroad; basic geologic work, followed up by industry, which speeded up development of the Metaline District; and geologic and geophysical work which resulted in expansion of iron ore reserves in the Iron River district of Michigan and the important talc discoveries in the Gouverneur district of New York.

Russia's Lead in Mapping

Director Nolan quoted an observation made by Dr. Helmut Landsberg of the Department of Defense made in 1954, that "Russia's position with respect to mineral reserves in many categories is already vastly superior to our own." An important basis for this position is mapping. Nolan said, "In the broad field of geologic mapping, the record shows that the Russians have mapped the entire country, including Siberia, at a scale of 1 to 1,000,000; that this has been followed by a second stage mapping at a scale of 1 to 200,000 which is said to be 30 to 40% complete; and this, in turn, by a third stage mapping of 1 to 50,000 which is said to be 4 to 5% complete."

Four important changes to the Mining Law of 1872 recently approved by the President were reviewed by Edward Woozley, director, Bureau of Land Management:

Public Law 167, signed on July 23, 1955 applies to mining claims on public lands and provides the managing Federal agency with control of surface resources not needed in actual mining operations. Under the old law this authority was not clear. Now mining claims located after July 23, 1955 cannot be used for any purpose other than prospecting, mining, or processing operations.

Public Law 359, signed Aug. 11, 1955. This law restores to mining location about 7.2-million acres of land that had been set aside as water and power site withdrawals in 17 States and Alaska.

Public Law 357, also signed Aug. 11, 1955. This act authorized the location of mining claims on lands classified or known to be valuable for coal, upon a discovery of associated uranium or other valuable source material.

Public Law 585, enacted Aug. 13, 1954. This law clears the way for developing locatable minerals in some 60-million acres of public land under oil and gas lease, and, conversely, permits oil and gas developments on lands under mining location.

A Refreshing Viewpoint

The Federal Law of 1872, which has long been attacked as unscientific and impracticable, received a thorough going over in at least two recommendations adopted unanimously by the Northwest Mining Association. These were:

1. To eliminate the costly nature of surveying lode claims for patent and to take advantage of the progress of public lands surveying in the public land states, permit location of a 40-acre legal subdivision on subdivided land as a single claim without extra lateral rights and without need for special survey for patent.

2. Provide for forfeiture of a claim if annual assessment work is not performed and recorded with the county recorder within a specified number of days after the end of the end of the fiscal year, and forbid relocation of a claim by the forfeiter for a specified number of days after termination of the recording period.

Three Slumps in Ten Years

Speaking on the long-range outlook for minerals, A. W. Knoerr, editor of *Engineering & Mining Journal* presented a Factbook showing that the

prices of copper, lead and zinc had slumped three times during the past 10 years. The Factbook included metal price charts relating the accumulation of stocks in the hands of producers to prices. In each case it was noted that continued rising stocks of metals signalled a price drop. Mr. Knoerr concluded that if nonferrous metal producers all over the world would trim production moderately to conform to demand, these cyclic price drops could be prevented.

"Over 95% Extraction"

Operating results at the Dawn uranium mill at Ford, Stevens County, Wash., were reported by Don Hargrove of the Dawn Mining Co. He said, "It is of interest to note that several per cent better extraction than test work indicated has been achieved. The test work covered a wide range of acid strengths, material sizes, temperatures and retention times. Optimum economic conditions seemed to require a minus 20-mesh grind, 130 pounds H_2SO_4 per ton, agitation temperatures of 50 deg centigrade and 16 hours retention time in a straight multi-stage agitation circuit to achieve 90 to 92% extraction. By using approximately the above conditions, but with a split leach circuit, over 96% extraction has been averaged in actual practice.

Most of the feed to the 440-ton Dawn mill comes from the company's Midnite mine located on the Spokane Indian Reservation, 22 miles northwest of the mill. Mining is open pit. The mine is extremely well located, Hargrove said, because most of the ore occurs near the crest of a ridge, thus minimizing stripping and waste disposal. Over-all stripping ratio of the deposits presently under development is 3:1.

Governor Reports on Alaska

Alaska's major item of mineral production is mercury, Territorial Governor M. A. Stepovich told the convention. Other metals being sought by mining men include titanium, nickel, chrome, iron, tin, lead, silver, platinum and copper. Total yield of Alaska minerals to date is valued at $1,133-million, he said.

Reporting on the recent new oil well brought in on the Kenai Peninsula, the Governor said that the discovery has set off a virtual stampede for oil and gas leases. Lease applications now exceed 16-million acres, and oil companies are planning expenditures of tens of millions of dollars to develop new producers.

Governor Stepovich said that the Territory needs a favorable economic climate to attract industry to develop natural resources. New mining operations receive a 3½-year exemption from the mining license tax, and mining operations are eligible for exemption from all territorial and local taxes up to 10 years under an industrial tax incentive program passed this year, providing such companies do some mineral processing in Alaska before shipment of products.

NEW OFFICERS of Northwest Mining Association are (left to right) E. K. Barnes, president, R. D. Leisk and Wallace G. Woolf, vice presidents, Robert J. Towne, secretary, and Frank N. Marr, treasurer.

Five Operating Sessions

Five sessions were devoted to practical operating techniques. Topics covered are listed at the close of this article. A five-member panel, chairmanned by Malcolm Brown, conducted a shaft-sinking symposium which directed attention to these items: Drilling and blasting, ventilation, mucking and hoisting, timbering, pumping and miscellaneous items. Case histories included projects using the Cryderman, Riddell and Hydromucker units.

A second symposium in the form of a single paper by W. E. Crandall and James Hunter, of the Hecla Mining Co., entitled "Comparative Sand-Fill Methods" also provided mining men with many useful pointers on this technique. Sand-fill methods for the Day-Rock mine, Galena mine, Knob-Hill mine and the Blackbird mine were compared.

Robert Lothrop, of Porter Brothers, presented a paper on dredging for rare earth and heavy minerals in central Idaho. The big problem confronting rare-earth producers is the possibility that some of the elements which are contained in the concentrates which they produce many suddenly blossom into exceedingly valuable products through advances in research.

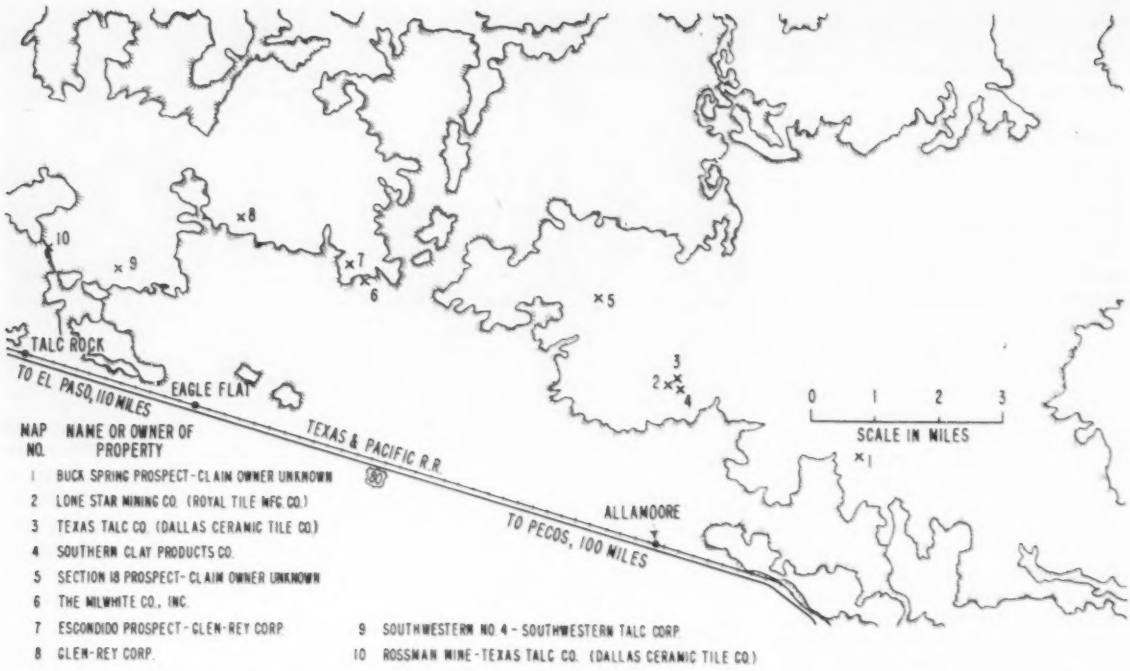
John Isbell, of Isbell Construction Co., said that the old rule-of-thumb methods of determining economic stripping ratios are completely outmoded because of the high cost of labor. Limiting ratios for waste to ore of 2: and 3:1, which were commonly accepted in years gone by, are giving way to ratios as high as 8:1 for copper properties during high-price eras, and as high as 60:1 in one uranium property. Isbell said that the value of hiring experienced contractors to do your earthmoving lay in these advantages: 1. Economy of centralized administration, equipment, accounting and engineering. 2. Flexibility of equipment. Rarely can a whole stripping program be carried out with a single suite of equipment. 3. The owner is relieved of the responsibility of mining. He specifies what he wants and pays for what he gets. 4. The experience acquired by the contractor in many projects makes him a qualified specialist in advising the best methods of pit planning and exploitation.

A forthcoming symposium on "Hydraulically Emplaced Fill" was announced at the meeting. The symposium will take place under the auspices of the Montana School of Mines at Butte, Mont. on May 8, 9 and 10. It will cover such subjects as applications of hydraulic fill, preparation of material, problems of transportation, stope and level preparation, and discussions on compressibility, cementation, and desired grain size of fill.

Officers for 1958

Newly elected officers of the Northwest Mining Association were: E. K. Barnes, president; R. D. Leisk, vice president; F. N. Marr, treasurer; R.

(*Continued on page* 152)


TALC ROCK
EAGLE FLAT
TO EL PASO, 110 MILES
TEXAS & PACIFIC R.R.
ALLAMOORE
TO PECOS, 100 MILES
SCALE IN MILES
0 1 2 3
MAP NO. NAME OR OWNER OF PROPERTY
1 BUCK SPRING PROSPECT - CLAIM OWNER UNKNOWN
2 LONE STAR MINING CO. (ROYAL TILE MFG. CO.)
3 TEXAS TALC CO. (DALLAS CERAMIC TILE CO.)
4 SOUTHERN CLAY PRODUCTS CO.
5 SECTION 18 PROSPECT - CLAIM OWNER UNKNOWN
6 THE MILWHITE CO., INC.
7 ESCONDIDO PROSPECT - GLEN-REY CORP.
8 GLEN-REY CORP.
9 SOUTHWESTERN NO. 4 - SOUTHWESTERN TALC CORP.
10 ROSSMAN MINE - TEXAS TALC CO. (DALLAS CERAMIC TILE CO.)

SOME HUDSPETH TALC operations require little stripping, and at the others loose overburden is removed without blasting.

Texas Miners Boost Talc Output

PETER T. FLAWN

TEXAS' HUDSPETH COUNTY talc mining, begun in 1952 when Southwestern Talc Corp. carried out pioneer exploratory operations, has expanded during the last five years and can today claim six active operations. These include (see map): (1) Southwestern Talc Corp., Llano, Texas, (2) West Texas Talc Corp. (properties sold to the Milwhite Co., Inc., Houston, in October 1957), (3) Texas Talc Co., a subsidiary of Dallas Ceramic Tile Co., (4) Lone Star Mining Co., subsidiary of Royal Tile Manufacturing Co., Fort Worth, (5) Southern Clay Products Co., also known as Christian & Sons, Gonzales, Tex., (6) Glenn-Ray Corp., (Georgia Talc Co., Chatsworth Georgia, operator).

Deposits occur within the Precambrian Allamoore formation in an area about 20 miles long in an east-west direction and 5 miles wide in a north-south direction. The Allamoore is a highly deformed and variably metamorphosed sequence of interlayered limestone and volcanic rocks, including thin beds of phyllite. The phyllite is commonly talcose—the amount of siliceous and calcareous impurities within the talc bodies shows wide variations. Phyllite units are mostly steeply dipping layers with a maximum thickness of about 200 or 300 ft which pinch and swell for a strike distance of up to several thousand feet. At Rossman mine (see map), two talc bodies occur as nearly vertical beds enclosed by cherty limestone members of the Allamoore formation. Except in the immediate vicinity of the talc, these limestones do not appear to be appreciably dolomitic. The main body is a tabular wedge-shaped unit about 7,000 ft long; it strikes about east-west, dips 70 deg to 85 deg south, and tapers from a width of 400 to 500 ft on the west to 100 to 200 ft on the east where it is cut off by a thrust fault. Talc is in contact with a small mass of diabase of uncertain age at orebody's west end.*

Problem of talc's origin has not yet been solved. The Allamoore formation is composed mainly of interlayered cherty limestone and volcanic rocks, and beds of cherty carbonate rock are known to occur within bodies of talc. Pinching and swelling beds of foliated talc are concordant in the sedimentary sequence and show little variation over a, strike distance of about 20 miles. There is no indication of origin through hydrothermal alteration of basic igneous rock either in the shape of the bodies or in the form of unaltered relicts. Detailed study of the talc bodies is necessary for a conclusive statement on their origin, but information available to date suggests an origin through alteration of sedimentary or pyroclastic rocks such as dolomitic marl or magnesium-rich tuff.

Mining methods.—Hudspeth County operations presently consist of a number of open pits which are still relatively small, shallow excavations; some quarries are planned systematic extractions utilizing from two or three benches with working faces ranging from less than 5 ft to 12 or 15 ft high. Other operations appear to consist of rather aimless earthmoving efforts with waste piled on extensions of the talc body.

Talc bodies are first stripped and cleaned by bulldozer. Some properties originally displayed relatively clean surface exposures and required little stripping; in other localities up to 30 ft of overburden has been removed. Fortunately, this overburden is mainly composed of soft unconsolidated alluvial or colluvial material and does

Mr. Flawn is geologist at the Bureau of Economic Geology, University of Texas.

*King, P.B., and Flawn, P.T., (1953) Geology and mineral deposits of pre-Cambrian rocks of the Van Horn area, Texas: University of Texas Publication 5301, pp. 170-172.

THIS PIT, Southwestern Talc's No. 4, is currently producing 40 to 50 carloads per month of ceramic-grade talc.

TEXAS TALC CO.'S surface outcrop is broken and loaded by a bulldozer mounted single tooth ripper and front loader.

not require blasting. Actual quarrying methods vary at different pits. One company employs a bulldozer equipped with a single-tooth ripper to prepare a surface for digging with a power shovel. In other operations talc is gouged from a face by power shovel without any previous breaking by blasting or mechanical methods. At still other pits the talc is broken by blasting with 80% dynamite prior to digging. Shovels in current use are of either ½ or ¾-yd capacity.

Region's main mining problems are caused by surface contamination and the sporadic occurrence of beds and lenses of chert and/or carbonate rock within the talc body. Upper part of orebody at and near the surface is a soft light gray material commonly veined by caliche and containing cracks and fractures penetrated by earth and vegetable matter. At greater depths the talc is darker, harder and contamination is not a problem. Beds and lenses of chert and carbonate rock within the talc are extracted and dumped. Some rough picking of deleterious material at the quarry is necessary to maintain a high quality product.

Crude talc is loaded directly into trucks without any secondary blasting or crushing and then transported to the railroad. All existing pits are within a few miles of the Texas & Pacific track. Loading is effected at Allamoore, Eagle Flat, and at a new siding known as "Talc Rock." Greater part of district's tonnage has moved through the Talc Rock spur where 12-yd capacity trucks dump directly from a ramp into boxcars, which carry approximately 50 tons of material. At Allamoore and Eagle Flat crude talc is put into boxcars with a front-end loader.

Production.—Production schedules in Hudspeth's talc district range from the 40 to 50 cars per month shipped by the Southwestern Talc Corp., to desultory shipments of a few cars per month from smaller operations. In October 1957, the following production was credited to the district: 1. Southwestern Talc Corp.—40 to 50 cars per month from their No. 4 pit. 2. Texas Talc Co.—12 cars per month, 8 from Rossman mine and 4 from the Chandler and Maloney pit. 3. Southern Clay Products Co.—10 cars per month from their section 8 pit. 4. The Milwhite Co., Inc.—15 cars per month from their section 28 property. 5. Lone Star Mining Co.—idle for more than a year; previously shipped about 7 cars per month from their section 8 pit. 6. Glenn-Rey Corp.—not producing; only a small previous production, mostly for testing purposes.

As of October 1957, 2,004 cars had been loaded and shipped from Talc Rock at the western end of district. This represents output from Southwestern Talc Corp. and the Texas Talc Co., and amounts to a total of 100,200 tons from two properties—the Rossman mine (Loyce No. 1 and 2 claims) and Southwestern No. 4. It comprises about 85% of area's total output. Production from the Dees ranch area to the east is not so well documented. It is estimated that eastern properties achieved a production of 20 cars per month in 1957, 10 cars per month in 1956, and a total of 25 cars in 1955 for a total output of 18,500 tons. Entire production of Hudspeth County district to date is in the neighborhood of 120,000 tons.

Costs and markets.—Because of easy open-pit near-surface mining conditions and proximity to railroad, Hudspeth County's talc district enjoys very favorable economics. Costs of mining, transportation, and loading into cars range from $1.75 to $3.00 per ton. Some of the talc is sold crude and some is freighted to eastern points and milled. Southwestern Talc Corp.'s mill is located at Llano, Tex.; Southern Clay Products processes the Hudspeth County talc at Gonzales, Tex. The final product is sold ground and sacked in 50-lb bags.

Nearly 90% of district's output is sold as ceramic talc and goes into the manufacture of wall tile; about 10% is marketed as insecticide carrier at a lower price than that quoted above. General market area ranges from Monterrey, Mexico, which absorbs approximately 25% of the area's entire output to as far east as Mississippi and Tennessee. The Texas market includes San Angelo, Santa Anna, Woodville, Tyler, Dallas, Fort Worth and Brownsville. Hudspeth County talc is a superior ceramic talc with excellent pressing, early strength, and firing characteristics.

Future.—District is in its infancy, and current operators are developing their own markets. Although a few properties have been explored by drilling, (there has not yet been a comprehensive study made of the district's reserves) they appear to be large. All known properties could sustain a higher production if the market permitted. According to production curves, a substantial increase in output is indicated for the next five years.

The author wishes to express appreciation to Mr. J. B. Upton of the Southwestern Talc Corp. and Mr. Gary Ard of the Texas Talc Co. for generously furnishing information on their operations, and to Messrs. Robert and Charles Dees for data on the talc operations on the Dees ranch area east of Hudspeth's district.

DISCUSSIONS following each paper were lively and gave audience opportunity to develop ideas generated by authors.

COFFEE BREAKS, served by faculty wives in equipment room, made for further talk. Homemade donuts made a hit.

Rolla Symposium Tallies Progress

BLASTING seemed to hold sharpest interest for most of those attending the Third Annual Symposium on Mining Research at Rolla, Mo., Nov. 14-15, 1957. But there was considerable and lively discussion of the other papers—ranging over ventilation, percussion drill steel and continuous boring. The event was jointly sponsored by University of Missouri School of Mines & Metallurgy and U.S. Bureau of Mines.

The roster, as noted at the start of the sessions by key organizer Dr. George B. Clark (chairman, department of mining engineering, Missouri School of Mines), showed a well-balanced attendance of technical men from among operating, manufacturing, government and university groups.

Robert W. Geehan (chief, division of mineral technology, Region IV Bureau of Mines) welcomed the 96 registrants prior to the first paper.

At the dinner meeting on Thursday evening, Marling J. Ankeny, director, U.S. Bureau of Mines, restated Interior Secretary Seaton's policy that the Bureau "is committed to place greater emphasis on mining research" as part of the Long Range Minerals Program. "One guiding element was that we would try to serve as many people as possible, avoid duplicating efforts by industry and likewise avoid becoming consultants to individuals," he added. He then proceeded to outline the Bureau's views on research in the industry which annually produces about 1.1-billion tons of minerals (coal and oil not included) having a value at the mine of $5.3-billion in 1956.

In considering a research program, the mining process—defined as starting with a deposit having some economic possibilities and ending with a raw mineral delivered to a plant for grade improvement—can be divided into four "functions":

"Preparatory" (mine valuation and design and selection of methods and equipment);

"Direct mining" (rock breaking, muck moving and ground support);

"Supporting" (ventilation, drainage, power, maintenance, and communications and controls) and

"Comprehensive" (general engineering and geology, safety, management, and office and supply services).

After enlarging upon what these functions embraced, he said: "Basically, the mining processes are concerned with the science of physics . . . specifically . . . mechanics, rather than with chemistry. . . . [Like those in other industries, engineers in mining and] especially those devoted to research . . . must be willing to specialize and . . . to study constantly so they can keep abreast of the latest scientific and engineering developments in the field and laboratory."

"This . . . specialization, brought about by the complexity of mining," suggests organizing into groups. Each group would comprise engineering, technical and scientific skills adequate to cope with problems of one or more closely related functions. Ideally, the specialized groups should be: "general engineering; drilling and fragmentation; ground stabilization and control; hydraulics and hydrology; ventilation, air conditioning and pneumatics; and mechanical and electrical."

In closing, Ankeny emphasized the cooperation and contributions of groups outside the Bureau and said: "They do not agree on all points . . . but this is a healthful atmosphere . . . a basic spirit of competition" and challenge.

Technical Program Was Varied

In the daily morning and afternoon sessions, audience discussion periods followed each paper. No hesitancy by audience or authors to ask pointed questions and get specific answers made these periods almost as meaty as the papers themselves. Ideas generated were generally mulled over some more at the coffee breaks at mid-morning and mid-afternoon.

Papers, to be available shortly as a bulletin of the School of Mines, were:

"The Fluid Network Analyzer for Solving Mine Ventilation Distribution Problems" by D. S. Kingery, chief, mine ventilation section, Bureau of Mines, Pittsburgh, Pennsylvania.

"Application of the Joy Microdyne to the Mining Industry" by A. Lee Barrett, director, research and development laboratories, Joy Mfg. Co.

"Drill Steel Developments in the Laboratory" by F. R. Anderson, assistant manager, Gardner-Denver Co., Denver, Colo.

"Development of Continuous Boring Machines for Coal and Other Uses" by L. D. Hagenbook, assistant vice-president in charge of engineering, Goodman Mfg. Co.

"Fracturing Under Impulsive Loading" by John S. Rinehart, assistant director, Smithsonian Astrophysical Observatory, Cambridge, Mass.

"Fundamental Research on Burn Cut Rounds" by Richard L. Bullock, research engineer, St. Joseph Lead Co., Bonne Terre, Mo.

"Use of Ammonium Nitrate Blasting Agents in Strip Mine Operations" by F. W. Parrott, manager, technical services, explosive division, E. I. DuPont de Nemours & Co.

"Properties and Recommended Practices for Use of Ammonium Nitrate in Field Compounded Explosives" by Charles M. Cooley, sales supervisor, industrial ammonium nitrate, Spencer Chemical Co., Kansas City, Mo.

"Large Diameter Blasting With High Ammonium Nitrate/Non-Nitroglycerin Explosives" by M. A. Cook, explosives research group, University of Utah.

Brief report on each paper follows:

Kingery

Ventilation changes are rapidly and cheaply investigated as to economic and safety aspects on specially designed computer of USBM. Mathematical solutions of complex networks, often too tedious to be practical, or alternative trial-and-error procedures, costly and uncertain, are thus eliminated.

Services of three-year old, room-size unit is available to mine operators. All Bureau needs is pressure-quantity survey notes for present flow and requirements or plans for any changes. Recent Information Circular 7809 describes simple pressure survey using topo-survey altimeters.

In practical example of application, taken from actual problem run on machine, time for solution was longer than if man-calculated. But it would be quicker on complex flows. Guesswork is eliminated and once a network is established any number of variations can be quickly investigated.

In analyzer, electricity is analogue of air. It was adapted by G. E. McElroy (USBM) from network analyzer developed by late M. S. McIlroy at Cornell. Tungsten-filament lamps give square-law resistance variation of usually-turbulent airflow, i.e., voltage varies as square of current. Linear resistances represent mine intakes, exhausts or regulated splits. And power input connections are at intakes and booster fans. Each load circuit contains ammeter to indicate flow. Ten circuits have semi-automatic control and another 40 have manual control.

Low cost of unit (about $24,000 with latest accessories) as against more expensive ($40,000), fully automatic German units was brought out in discussion.

Barrett

Dust problems in ventilation and stack exhausts can be approached in new ways with unusually compact, lightweight, easily-installed Joy Microdyne dust collector. Impingement-type, tubular duct-type unit can be used at dust-making location to cleanse air and return it like a recirculating air space-heater. Water consumption is very low.

Collector is outgrowth of one originally developed by Jack Warren of Anaconda.

Incoming particles are entrained in water as they bounce through spray-wetted accordion-folded screen. Screen —stainless fly type—has "V's" pointed upstream. Dust containing droplets, suction blown off screen, are carried by air flow through rotating assembly of radial vanes which deflect air, giving centrifugal effect which throws droplets to wall of tube. Slots in wall lead water to collection tank. At end of collection chamber, second rotating vane assembly (shaft connected to first) recovers energy as it straightens air flow for entry into fan.

Proper design of wetting screen, vane angles and hub, and water collection system required considerable investigation. One factor was the very high air velocity present.

Several mine applications — underground crushers, continuous miners— were cited. They indicate considerable cut in ventilation requirements.

Use in processing plants is promising. Temperatures up to 1000 deg F appear to be feasible.

"Performance" is close to ultimate of bag house or electrostatic collector, often even exceeding latter in practice. But it is not suitable for fibrous material which clogs screen.

In discussion, it was mentioned that fresh (field) dust collects easier than same dust in lab tests. Idea of applying unit to diesel exhaust scrubbing was briefly explored.

Anderson

Drill steel investigations in the laboratory continue to establish many design principles for improving performance. Although metallurgical aspects are highly important, mechanical aspects are equally or even more important.

Major impetus to research on drill steel was development of tungsten carbide into an effective cutting element.

Early work by Gardner-Denver with strain gages showed that stresses on outside surface of drill steel were often above endurance strength of plain carbon rods and that dull bits and misalignment greatly intensified the stresses.

Recently, in studying why alloy steel rods have life four times that of plain carbon, changes in length as 6-in. pieces were progressively turned down showed that at surface of center hole, residual pre-load tensile stresses, due to non-uniform cooling, were 50,000 psi for carbon versus zero for alloy.

Another investigation aimed at increasing shank life has proved that shank face hardness can be raised to tappet's hardness if design includes case-hardened structure and corner radius of ¼ in. Photoelastic studies showed such radius, rather than usual 1/32 in., cut chipping stresses 80%.

More recent research on energy transmission, using bonded wire strain gages with oscillograph and validated by rock drilling, indicates that: drill steel delivers only 10 to 27% of hammer's energy to bit, carburized rod is 6½ to 46% more efficient than conventional type, and joints add losses.

Latest studies on energy transmission with oscillograph concern vibrations induced by impact. They show that end pulses die out between blows of rock drill but bending vibrations do not. Although so far they appear rather academic, the studies do help to evaluate design of drill, rod and bit and also point out evils of too small diameter steel, too heavy a drill, dull bits, poor feed and misalignment.

As a supplement to his talk, Mr. Anderson described his company's new "Moledrill," a down-the-hole percussion unit. And the questions dwelt mostly on it.

Some of the aspects of the sound-like vibrations in drill steel were also discussed. The wave becomes tensile when reflected from the ends and the wave length can affect breakage of certain lengths of rod.

Cooley

Ammonium-nitrate produces larger gas volume upon detonation than any other explosive material commonly used and is cheapest explosive energy available to open pit operators. Use of AN has spread to any type of open cut, primarily because of cost saving feature coupled with a performance superior to average blasting material previously used.

Now fuel oil mixes have made hole diameter less critical: "With liquid additive and correct priming, excellent results can be obtained in 2- and 3-in. blast holes."

First prepared in 1659 and used in dynamites since 1867, AN really caught attention of mining men with fairly recent development of "Akremite" for coal stripping.

Normally NH_4NO_3 is a very stable salt. Of four decomposition reactions, two are most commonly considered. First, when heated to 200-260 deg C, it decomposes as: $NH_4NO_3 \rightarrow NO_2 + 2\ H_2O$. This reaction can be controlled and is used to make nitrous oxide. But with extreme heating or by shock of powerful explosive, under confinement a rapid, violent reaction takes place: $2\ NH_4NO_3 \rightarrow 2\ N_2 + 4\ H_2O + O_2$.

Rate of detonation of pure ammonium nitrate varies from 6,600 to 11,900 fps. Smaller particle size, lower apparent density, greater confinement and higher efficiency of primer serve to increase speed, as do certain additives. Speed tends to decrease as it proceeds. Actually, many explosive compounds used fall within same range. In spite of low velocity and high gas volume (generally giving low shatter and good heave), working results show shatter is greater than expected (ascribed to very large volume having disportionate effect).

Superiority of prilled AN is laid to fine particle size and porosity, which gives low density, and which is space conforming for good confinement, and gives more intimate distribution of additive.

Density of carbo-ammonium nitrate mixes is not as closely controlled as commercially manufactured explosives. Yet it is considerably important, for as density increases, sensitivity to detonation decreases, both in pure AN and in mixes. Pure AN will not detonate at

density of much more than about 1.0.

Additives can be carbon black, powdered coal or fuel oil—alone or in various combinations. Six to eight per cent fuel oil gives best performance, particularly with prilled AN containing 3% inert parting agent.

Proper detonation of prill-oil mix determines its effectiveness. Generally booster of 60% dynamite or equal is satisfactory but lower strengths have worked. Confinement, i.e., resistance of rock, plays key role, too. With proper quantity of booster, the greater the confinement, the more nearly AN velocity approaches that of booster. While AN-oil mix will not exceed its own particular maximum velocity, if enough booster is distributed, average velocity may go up to some value between mix and booster.

Quantity of booster depends on a number of field conditions. As with any explosive, a minimum quantity of primary material is needed to secure complete detonation and, in addition, detonator must be above certain minimum size. Field tests show detonating explosive should be a certain per cent of total charge (by weight) for certain hole diameter. Starting points are: 2- to 4-in. holes, 25%; 4- to 7-in., 10%; 7-in. up, 5%. Priming is more effective with a series of smaller charges but not if carried to extremes.

Handling of AN is given in brochure of Manufacturing Chemists' Association, available from Spencer Chemical Co. But once AN is mixed with oil it should be treated like high explosive.

Discussion centered on small hole application. Remarks indicate prill-oil mix has been used in 1⅝-in. holes using 450- and 180-grain detonating cord. One comment clarified blasting agent terms of nitro-carbo-nitrate (e.g., Nitramon) as being an AN-TNT mix, whereas carbo-ammonium nitrate is equivalent term for AN-fuel oil or carbon mix (e.g., Akremite). Another comment mentioned maximum detonating velocity of prill-oil mix as 14,500 fps.

Hagenbook

Continuous boring has been under development for 75 years. It dates back to 1881 when the English "Stanley Header" made a 7-ft dia bore 1¼ miles through chalk under the English Channel. About 1910 Mr. Stanley built an apparently unsuccessful borer for a Colorado coal company. Later McKinley built a successful unit and over next decade made others for use in West Virginia. Development of similar machines by several companies was speeded up as mid-century approached. Present units cost around $125,000, use 100-200 hp, weigh 75,000 to 85,000 lb, and produce up to 450 tons per shift.

Some factors that stimulated use and development were: increased use of fine size coal, development of crawler treads, increased cost of labor and development of tungsten carbide.

The "Stanley Header" cut a circumferential kerf and a center hole (used to blast off core). Later coal units used multiple kerfs. But fewer kerfs mean less fines and less power consumption. Thus, wedging devices were developed to break off core. Wedging is outward from center to avoid core's arch strength. Natural ground stress was found to aid break off. Most successful wedge is tapered roller which, having large contact area, can exert high pressure without locally crushing coal. But for harder rock, a disc that splits rather than breaks off core seems best. With it, severe misalignment loads result. A notched disc has promise.

Studies on design of kerf-cutting element indicate that multi-tooth device is more efficient than single-tooth. Lead tooth should be followed by one to each side. If more than three teeth are used to get final width, they should be mounted in steps to take equal load. In harder rock wider kerf is best. Chatter due to variation in hardness of rocks is problem and heavy machines are needed. "Sulphur (pyrite) balls," slate and salt can be cut but so far a hard-limestone borer is unsuccessful.

Excerpts from U. S. Steel's 4000-frame-per-second motion picture of a borer cutting "sulphur" showed the explosive force with which rock breaks, as well as the intermittent deflection and penetration of the bit.

Test apparatus for measuring "cuttability" of rock has aided design and development for some time.

Rinehart

Metal-explosive systems tested show that time of loading affects mechanical properties of materials quite markedly. Stress distribution under such impulsive loads varies greatly with time in contrast to static loading. And although study concerned metal fracture, implications probably extend to other materials, too.

Velocities of elements involved vary. Whereas stress waves propagate at 3,000 to 20,000 fps, cracks or fractures propagate at maximum of 5,000 fps and particle velocities are only a few hundred feet per second.

Most characteristic feature of fracturing under impact is a well defined, reproducible break pattern—far more so than under static loading. Fractures are closely related to interference between several stress waves—often generated as a result of reflection from boundaries. Geometry of body is highly important.

Scabbing fractures result from tension due to interference between original compressive wave and its reflection at a boundary.

Multiple scabs may result when maximum stress of initial compressive wave is more than double critical fracture stress of material. The fact that compressive waves can pass an interface, while a tensile wave cannot, has an influence.

Corner tensile fractures result from reinforcement of two or more reflected waves moving in from two or more surfaces. Similar breaks can occur at center of body, too.

Radial tension splits occur in thick-walled cylinders loaded along longitudinal axis because of differential particle velocity resulting from expanding wave front.

Shear fractures along trajectories of maximum shear (a series of intersecting exponential curves) are especially apparent as 45 deg splits around surface of center hole of thick-walled tube loaded from outside. Blast against flat plate gives more evidence of such shear fracture.

Inability of material to expand rapidly upon release of load often contributes to fracturing. An example is mid-point split parallel to faces of plate after simultaneously loaded from both faces. Plastic flow and stored energy is involved in this phenomenon.

Bullock

Shatter cut for long rounds, using large open relief holes, has been developed to speed drifting. Final pattern has 1⅜-in. loaded hole at each apex of equilateral (10 in.) triangle, 1⅜-in. open hole at center and 3-in. open hole ¾ in. outside midpoint of each side. With low velocity (5,500 fps) explosive, 12-ft holes in Bonne Terre limestone give 10- to 12-ft advance per round, 95% of time with powder factor (1.41 lb per ton) equal to usual 5- to 6-ft pyramid rounds. No other known burn cut gives such results.

Basic principles cited were:

1) spacing of holes (i.e., volume of cut) depends on size of open holes (i.e., volume of relief)—if too great it will not clear;

2) energy (force and fracture effect) of explosive must not exceed that needed to break rock loose and expel it—recompaction results if greater;

3) timing of holes and avoidance of sympathetic detonation must permit each hole to break-expel individually;

4) size of relief hole must be large enough to compensate for hole deviation.

A very comprehensive study of past and current theory and practice preceded considerable field experimentation. Among other findings were:

Brittleness and structure of rock play a big part in success of patterns.

Breakage appeared to be by shear rather than tension-slabbing and/or crushing.

Holes must be charged to collar to get breakage for full length.

Booster (delayed charge in bottom of open hole) is unnecessary for cleaning debris if pattern and blasting is proper.

Sympathetic detonation is apparently caused by shock wave in air, rather than in rock.

Large relief hole and orientation of pattern best avoid limits of length of burn cuts imposed by hole deviation.

(*Continued on p 110*)

Union Carbide's uranium mill, Uravan, Colo.

LARGE URANIUM PRODUCER picks dozens of "U.S." Belts for a dozen different uses

High up on the mineral-rich Colorado plateau, one of the nation's biggest uranium-processing plants is operating on a 3-shift, 7-day-a-week basis. U.S. Rubber Conveyor Belts play a vital part in its operation.

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(*Continued from page 108*)

Parrott

Ammonium nitrate now probably accounts for about 90% of energy used in commercial blasting. Although water-soluble and hygroscopic and only about 70% as strong as nitroglycerin, it has advantages of economy and safety that make it a useful replacement for NG in dynamites. Part of economy results from its low-cost mass-production as fertilizer—a post-World War II development.

Starting in 1935 Dupont introduced "Nitramon"—a canned non-nitroglycerin ammonium nitrate blasting agent—and others in that family. A few years ago Maume Collieries developed "Akremite"—fertilizer grade AN locally mixed with solid carbon and packed in an expansible plastic bag to aid tight confinement. Because oil is cheap, convenient and available, it has replaced solid carbon as a source of fuel—No. 2 fuel oil fits bill very well.

Most recent and simplest practice is to pour oil directly into hole as AN prills (i.e. granules) are likewise poured into hole directly from shipping containers.

Success of such procedure is credited to low density and high confinement. Practical proportion of oil is 5 pints per 50 lb of AN. It results in an agent equal in weight to 50-60% dynamite.

Priming is key to complete and effective detonation. Primer should be at least 40% strength dynamite—higher the strength and velocity, the better—and quantity should be on order of 10 lb. To raise reliability, some operators use primer to AN ratios up to 20% by weight. For greater safety—since hazard is caused by weakest link—non-nitroglycerin primers are recommended.

Use of AN in wet holes is impractical—if packaged, confinement is lost. Use in horizontal holes faces same problem of lack of confinement—heavier priming can help.

Safety precautions for handling of AN prill-fuel oil mixtures are same as recommended for fuel oil. Fire is greatest hazard. But field storage magazines should be same as for high explosives. AN alone should be handled according to regulations governing it as fertilizer.

A real hazard exists if other chemicals are used as sensitizer and fuel. Mixing of high explosives into prill-oil mix is very dangerous.

Discussion covered underground use and brought out: in small diameters sensitivity is unrealiable; fumes are bad; and confinement and loading are problems.

Cook

AN-fuel oil mixes' ratio of cost to available energy is only 25 to 30% that of comparable strength dynamite. This low cost has not only offset its weaknesses but has even led many to fail to recognize them. Aside from cost, an explosives' performance under particular conditions of use is based on: sensitivity, i.e., detonating and propagating consistently; pressure-time curve's shape, including peak pressure; and energy available. These factors involve critical diameter, minimum booster, detonation velocity and other more common terms.

For good performance, even in large diameters, AN-HC (i.e., hydrocarbon) mixes need precise boosters, fine granulation, intimate mix and good confinement. Even so, their velocity is lower (and not strictly constant), and their pressures are much lower and peak much later than conventional types. Their strength by weight is probably comparable to about 50% dynamite.

Prills are readily and evenly penetrated by fuel oil without agitation. A 94/6 weight percentage gives best sensitivity and velocity. For such mix: unconfined critical diameter is 4 in. and minimum booster is 40 g of "50/50 cast pentolite" or equivalent; confined in 1½-in.x6-ft drill-holes, 80 g is effective and usually two 1¼x8-in. sticks of 50% gelatine dynamite will cause propagation.

Multiple point priming does not produce an "overdrive" (i.e. raise velocity above that of one-point detonated AN mix).

With light burdens (generally the case with small holes) late pressure-peak is detrimental. But for easily broken rock, longer "push" is often considered desirable.

Prill-mix fills hole well, giving confinement not often achieved with other explosives.

Minnesota Holds Exploration Drilling Symposium

HIGHLIGHTING aspects of exploration drilling, the Seventh Annual Drilling Symposium sponsored by University of Minnesota was held in October. Reports indicated the conference was the most successful yet sponsored in the series on Exploration Drilling. First held at Duluth in 1951, this year the Symposium attracted some 175 experts from many fields and from Canada, Venezuela, England, India and British Guiana.

Subjects were timely and covered enough to interest the geophysicist, geologist, mining engineer, civil engineer, and drill contractor, manufacturer and metallurgist. The program had five principal themes: geophysical instrumentation of small boreholes; weighting and reliability of drill hole samples; small borehole surveying; diamond drill bits; and air and mud as flushing media in exploration drilling.

The speakers outlined the considerable advances being made recently, and their papers as presented in these Proceedings represent one of the most comprehensive coverages yet published on this particular subject. The trend toward better core recovery and a more critical use of sampling results, an essential in the development of marginal low-grade deposits at depth, provided the reasons for a thorough discussion of these problems by a panel of specialists. After opening the subject of small borehole surveying, and emphasizing the need for a small gyroscopic compass, the group was offered the first promise of a gyroscopic instrument that might be adapted to the surveying of 2 in. dia holes.

The special problems of coring unconsolidated materials and ice, together with the use of mud and air for a flushing medium instead of the conventional water, interested many of the listeners faced with similar conditions. Great strides have been made in this area recently by men in both the soils mechanics field and the mineral industry. Papers on new and versatile drilling units and the most recent diamond drill equipment standards, as set by the Diamond Core Drill Manufacturers Association and accepted in various parts of the world, rounded out the meeting.

Copies of the published Proceedings are to be available shortly from: Mr. Merrill Cragun, Center for Continuation Study, University of Minnesota, Minneapolis 14, Minn. Curriculum was:

Geophysical Instrumentation of Small Bore Holes—Chairman: Harold M. Mooney

Possibilities and Limitations of Drill Hole Geophysics: J. E. Blanchard

Drill Hole Electromagnetic Exploration for Sulphide Ores: Philip G. Hallof

Geophysical Exploration from Drill Holes in the Lake Superior District: George V. Keller, Charles Zablocki

Application of Drill-Hole Geophysics to Mining Exploration: E. J. Moore

Radioactivity Surveying of Drill Holes: R. A. Broding

Schlumberger Electrologging of Drill Holes: Burton H. Boyum

Weighting and Reliability of Drill Hole Samples—Chairman: Stephen Erickson

Methods of Combining Core and Sludge Analyses: Donald H. Yardley

Comparison of Mining Grades with Estimated Grades for Iron Ores: Josiah Royce

The Chuquicamata Combining Method as Applicable to Ferrous and Non-Ferrous Ores: Glenn C. Waterman

Statistical Evaluation of Sampling Results: George Jewett

Statistical Approach to Sampling and Grade Estimates—(Panel Discussion)—Moderator: Stephen Erickson. Panel Members: Scott Hazen Jr., George Jewett, William Van Slyke, Paul Zimmer. General Session—Chairman: Jack W. McBean

Diamonds and Their Role in Drill Bits: Patrick Adamson

Surveying Methods for Small Diameter Bore Holes: James D. Cumming

The Gyroscopic Compass, Its Principles and Possible Adaptation for Surveying of Small Bore Holes: Jack W. Lower

The Impregnated Diamond Drill Bit (Panel Discussion)—Moderator: J. W. McBean: Panel Members: I. L. Reid, George R. McWilliams

Air and Mud as Flushing Media in Exploration Drilling—Chairman: William J. Whinnen & Burton H. Boyum

Core Drilling in Frozen Ground: M. Juul Hvorslev. Thomas B. Goode Discussion by: G. Robert Lange

Improvement of Core Recovery by the Freezing Method: Robert R. Carver

Sampling of Beach Sands: Eugene V. Whittle

Mud Drilling with Wire Line Core Barrel: Vernon Read

Operation of a Truck-Mounted Rotary Drill Rig: G. J. Anderson, R. W. Hillmer

Review of Backoff Shooting and Drill Hole Cementing: Vernon Read

A New Method for Drilling and Recovering Poorly Consolidated Formations: Ned Miles

Luncheon—Chairman: Fred E. Berger—"Current Status of Diamond Drill Standardization": Frank C. Sturges: Dinner—Chairman: J. M. Nolte—"A Sourdough Reminisces": Lute J. Parkinson

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Integral steels with 50% longer life

Sandvik Coromant integral steels have up to 50% longer rod life than ordinary steels, thanks to anti-corrosion SR-treatment, which protects them during transport, storage and actual drilling. In addition, air-tight plastic caps give bit and shank extra protection during transport and storage. They are available in these standard sizes:—

$\frac{3}{4}$" hollow hexagon	1'4"-13'1"
$\frac{7}{8}$" hollow hexagon	1'4"-21'0"
1" hollow hexagon	2'6"-21'0"
Flexible drill steels	2'7"-31'6"

Precision-made rock bits

The threads of Sandvik Coromant (cross and X-design) bits are precision milled. The bits are so accurately manufactured that not only smoother drilling but *longer life* are ensured. Standard bit diameter sizes range from $1\frac{1}{2}$" to $4\frac{1}{2}$". The 773 bits (bottoming type) are available with GD400 and GD600 thread, or with $1\frac{1}{4}$", $1\frac{1}{2}$" and 2" rope thread. The 776 bits, for standard shoulder-type drill rods, are available with threads ranging from $\frac{7}{8}$" to $1\frac{11}{16}$".

Efficient extension steels

The rope-threaded joints of Sandvik Coromant extension steels are solid and make joining and unscrewing extremely easy. Sizes available: $\frac{7}{8}$" and 1" hexagon steels, $1\frac{1}{4}$" and 2" round steels. A special feature of the $1\frac{1}{4}$" equipment is the $\frac{1}{2}$" flushing hole, about twice as large as most. This gives better cleaning of the bore hole and a higher rate of advance, reduces wear and risk of steels sticking. The 'cold rolling' technique makes this wider flushing hole possible *without any loss of strength.*

Wide variety of Stone Working Tools

A single plug hole steel made by Sandvik is capable of drilling up to 1000 holes, each about 3.9". Sandvik Chisel Steels are made with rubber sleeves to reduce vibration and protect the worker. Sizes available: Plug Hole Drill Steels with bit diameters ranging from approx. $\frac{21}{32}$" to $\frac{7}{8}$". Chisel steels with bit diameters from approx. $\frac{5}{16}$" to $\frac{25}{32}$".

The World's foremost drilling unit

Sandvik Coromant extension and drill steels have been developed in close co-operation with Atlas Copco, manufacturers of rock drills and other compressed air equipment. The combination of Sandvik steels and Atlas Copco rock drills is the world's most widely used drilling unit—responsible for the drilling of more than one thousand million feet each year!

Write, phone or cable today for further details to any of the addresses below:

Atlas Copco

EASTERN *P.O. Box 2568 Paterson 25, N.J.* **PACIFIC** *930 Brittan Av, San Carlos, Calif.*

CANADA *Montreal Airport, Quebec.* **MEXICO** *Apartado Postal 56, Torreon, Coahuila.*

D5577A

WHAT'S NEW IN U.S. PATENTS

OLIVER S. NORTH

Exploration

Seismic wave generation method whereby an increased proportion of the energy travels along desired paths. Explosive charges are so placed largely to avoid interference between waves travelling by different paths from charge to receiver. J. D. Eisler and D. Silverman, assigned to Pan American Oil Corp. No. 2,808,894.

Improvements in apparatus useful for sampling ore bodies and other underground formations. Core tube is driven into formation by explosive means. Exhaust gases are released to facilitate recovery of the tube and contained ore sample. C. C. Laval, Jr. No. 2,809,805 and 2,809,806.

Diamond core bit having channels for passage of rock particles and cooling water grooves across the reaming and cutting faces. L. Catallo, assigned to Wheel Trueing Tool Co. No. 2,809,808.

Testing procedure and arrangement for determining optimum spacing and layout of seismometers and/or shot points in areas where prior experience or techniques are lacking. K. Dyke and M. B. Widess, assigned to Pan American Petroleum Corp. No. 2,810,444.

Method for orienting cores from the known orientation of a side wall core taken at the same depth. Physical properties, such as direction of magnetic polarization, are correlated. J. D. Martinez, assigned to Esso Research & Engineering Co. No. 2,810,548.

Method and apparatus for correcting plurality of seismic traces for the effects of normal moveout time variations. Movement of recording heads is programmed in accordance with movement of a resilient deformation member. E. P. Meiners, Jr., assigned to California Research Corp. No. 2,810,898.

Reflected-neutron logging of formations traversed by boreholes. Apparatus is highly sensitive to reflected slow or thermal neutrons only, and is unaffected by other radiations. E. R. Atkins, Jr., and P. G. Nahin, assigned to Union Oil Co. of California. No. 2,811,649.

Mining

Improved grinder for sharpening chisel-type rock drill bits. Apparatus is simple, rugged, and low in cost. B. V. Nyholm, assigned to Atlas Copco Aktiebolag. No. 2,809,470.

Percussion rock drill of the down-hole type. Drill is inserted into hole, thus eliminating energy lost when the hammer blow must travel through several drill stem sections. Means are provided for absorbing piston reaction. W. A. Morrison, assigned to Ingersoll-Rand Co. No. 2,810,549.

Mr. North is patent consultant, Washington, D. C.

Apparatus for lowering explosives into quarry blast holes. Rope used for lowering explosive has automatic release hook for disengaging from charge when latter is at bottom. Device permits rapid, safe loading of down holes. C. A. Blackburn, assigned to King Powder Co., Inc. No 2,811,334.

Metal and Mineral Processing
Ore Dressing

Improved ball mill liner having a series of spirally extending ribs or lifters. Rib segments are so formed that the ends of ribs on each plate are not susceptible to being chipped during use. A. J. Roubal, assigned to Allis-Chalmers Manufacturing Co. No. 2,809,789.

Pneumatic separator for sizing ores of mica, gold, tungsten, etc. Cyclonic air movements are created on opposite sides of a straight air flow carrying crushed ore. Resulting suction pulls lighter particles out of the straight air flow. F. H. Clute, assigned to Clute Corp. No. 2,808,151.

Underwater screening device useful in cyanidation of slimy precious metal ores, for example, saprolitic gold ores. Means are provided for extracting the metal values from the ion exchange resin by passing the extracting solution through the resin-containing cells. Initial and maintenance costs are low and output is high. D. Kaufman and G. W. Lower, assigned to American Cyanamid Co. No. 2,808,928.

COPIES OF U. S. Patents can be purchased at 25c each from the Commissioner of Patents, Washington 25, D. C.

New collector for use in flotation recovery of copper, gold, or zinc from low-grade sulphide ores. Reagent is a sulphur-linked allyl ester of alkyl xanthate. R. B. Booth and D. E. Ailman assigned to American Cyanamid Co. No. 2,808,931.

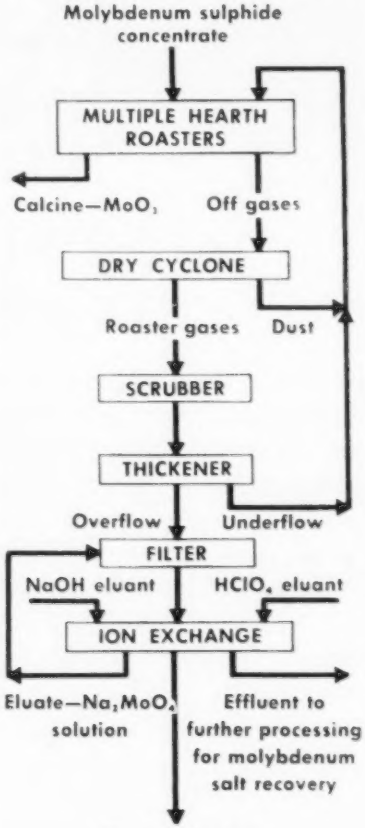
Improved hydraulic classifier for sorting mineral particles by size. Water supply is automatically varied according to variations in density in the chambers. Apparatus is reliable, easy to adjust, and relatively inexpensive. W. H. Hisle, assigned to American Chrome Co. No. 2,811,257.

Pyrometallurgy

Improved method of smelting ilmenite. Mixture of titaniferous ore and a solid carbon is fed to a three-phase electric arc furnace. Products are titanium slag concentrate and molten iron. R. S. Miller and G. G. Hatch, assigned to Quebec Iron & Titanium Corp. No. 2,808,324.

Method for refining ores of uranium, tungsten, molybdenum, and vanadium. Ground ore is treated in the fluidized state. Products derived are high-purity halides, especially fluorides. Process is particularly useful for producing uranium tetrahalides. E. V. Murphree, assigned to U.S. AEC No. 2,811,414.

EXTRACTING RHENIUM



Extraction of rhenium incidental to manufacture of molybdenum oxide. An ion-exchange technique is used. Advantages include greater recovery of rhenium, single-stage roasting, low-cost recovery of rhenium as a by-product at existing operations, and production of rhenium compounds of high purity. Figure is a flow diagram showing application of this process. S. R. Zimmerley and E. E. Malouf, assigned to Kennecott Copper Corp. No. 2,809,092.

Preparation of titanium dioxide concentrates and metallic iron from ilmenite ores or concentrates. Ground ore is heated with NaCl in reducing atmosphere, forming spherical pellets or beads, which are heated with a carbonaceous reducing agent to convert iron values to metallic iron. Pellets are then ground to 325-mesh and magnetically separated into Fe and TiO_2 fractions. O. Moklebust, assigned to National Lead Co. No. 2,811,434.

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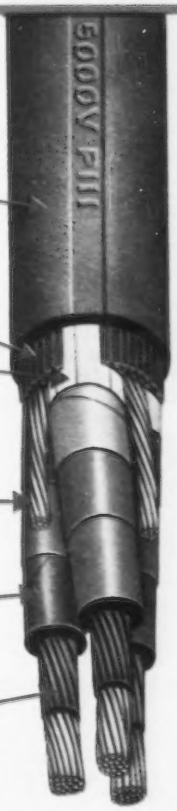

Tough, long-wear Roeprene® sheath wards off moisture, retards flame, resists oil, corrosion, abrasion. Meets flame-resistance requirements of Pennsylvania Dept. of Mines and carries symbol P-111.

All-rubber fillers for moisture resistance, splicing ease.

Tin-copper shield tape for added safety of operation.

Adequate ground wires, in contact with conductor shielding. Grounds equal more than 90% of circular mil area of single power conductor, for complete grounding and fault return.

Butyl insulation for heat-, moisture-, ozone-resistance. Rated at 90° C copper temperature through 5000 v; 85° C through 15000 v.

Semi-conducting tape around each conductor prevents excessive voltage stress and ionization between conductor and insulation.

These are features that add up to longer, better, more economical service. Even at peak loading, rugged Roebling Mine Power Feeder Cable gives peak performance!

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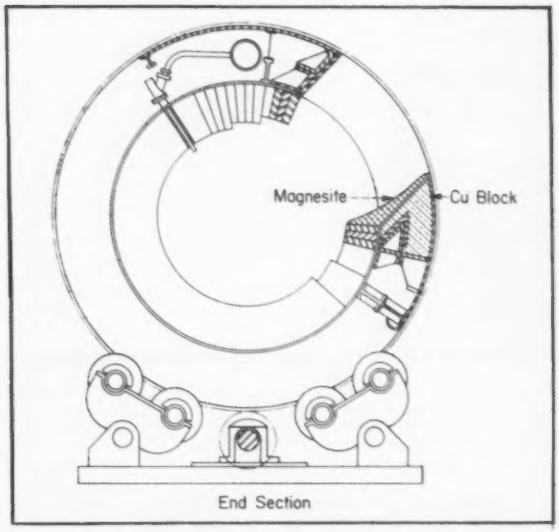
OPERATING IDEAS



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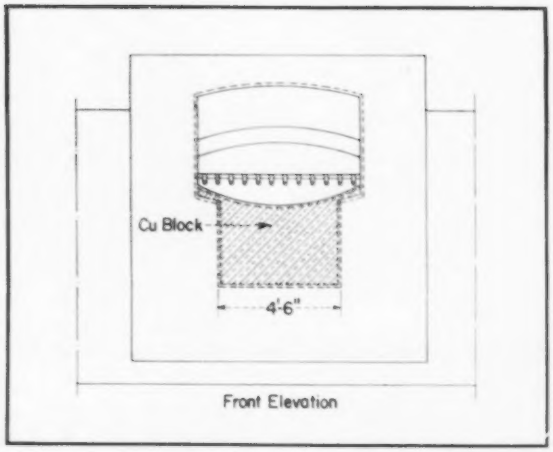


Front Elevation

Cu Blocks Fortify Converter Lips

USING A COPPER BLOCK FOR THE POURING LIP on copper converters has cut lip wear at Mt. Isa Mines Ltd., Queensland, Australia.

J. W. Foots, general manager, said "Large size of the block is necessary to provide sufficient cooling capacity to keep a layer of frozen material between the block and the molten slag or copper. The copper block is cast in place by constructing a forming made up of ½ in. plate. Before casting the block, converter is positioned so that the top side of the pouring lip is in a vertical plane.

"Original steel lip was subject to many burnouts and was modified to include a steel box filled with magnesite brick. This was an improvement, but still not satisfactory because bumping of the lip dislodged the bricks and a narrow channel was soon cut into the lip, making fast skimming difficult.

"Some corrosion in the center of the lip has occurred after a production of 8,000 tons of blister copper. This indicates that the cooling effect is still not sufficient when the front of the lip is covered with an insulating layer of hot slag, caused by splashing from the converter. To overcome this, the next step will be to cast a water coil in the bottom section of the copper block. This should prevent the block warming to a red heat, at which temperature corrosion takes place quickly, and give the lip an almost indefinite life."

The difficulty in making a satisfactory pouring lip on the Mt. Isa converters is due to the severe conditions to which the lip is subjected during blowing and skimming operations. The 10x20 ft converters are operated on an average air volume of 10,000 cfm which is high for vessels of this size. At times this causes excessive splashing and subsequent corrosion of the lip and apron plate below the lip. Only single converter operation is practiced, which makes it necessary to skim the final slag very slowly. Also, when a charge is finished, the remaining slag is held back with a bank of silica flux, and the copper poured out carefully from underneath.

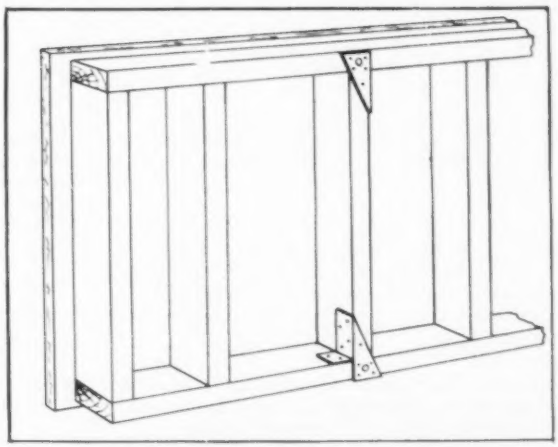
Of course, with multiple converter operation and a holding furnace or anode furnace to receive the copper charge from the converter, the problems are not so severe.

Anchors Lengthen Form Life

SERVICE LIFE, STRENGTH AND RIGIDITY of prefabricated reusable concrete form panels are boosted by Trip-L-Grip framing anchors, according to Timber Engineering Co., research affiliate of National Lumber Manufacturers Association.

The new panels, helping to hold down construction costs, employ the usual type of frame, consisting of 2x4's on which plywood is nailed. But instead of resorting to the customary spikes or perforated strips, the system uses Teco Trip-L-Grip framing anchors to join whalers to studs.

Anchors provide nailing on three sides of a joint, and with all nails in shear, the panels are better able to withstand twisting, bulging, and racking resulting from heavy use. Teco anchored panels can be easily removed and re-used many times, with minimum repairs, the company reports.



Indicator Chemical Finds Leaks

MICROSCOPIC LEAKS in equipment are easily found by using bromcresol and ammonia, say reports from aircraft (fuel tanks, seals, etc.) and chemical industries (jacketed fermenters, etc.). At Bristol Lab., Syracuse, N. Y. jacket of fermenter tank was pressured with ammonia, tank's inside was brushed with slightly acid bromcresol solution, and as ammonia seeped in, wall surface changed from yellow to purple. Other detection schemes are more expensive and complicated (radioactive tracers), too large for tight-area work (helium mass spectrometer) or not sensitive enough (dyes).

OPERATING IDEAS *(Continued)*

DENVER ROUGHER FLOTATION

SAVES $15,000 YEARLY*

* Recent Case History

Mill: 4,000 T.P.D. low-grade copper ore.

Circuits: Two 2,000 ton per day parallel flotation circuits.

Flotation Machines: DENVER Roughers and a leading competitive rougher. All of the cleaner cells were DENVER "SUB-A's."

Operating Conditions: Identical.

Metallurgy: Equal.

Initial Cost: Substantially the same.

Power Savings: With equal metallurgy and equal tonnage the DENVER Rougher circuit SAVED approximately $10,400 per year over the competitive circuit!

Part-life Cost: Longer wearing life of DENVER parts saved an estimated $4,500 additional per year!

Unseen Factors Control Your Net Profits...

Even though this $15,000 saving per year per 2000 ton circuit did not appear on an assay sheet it was real and vitally important. It was not overlooked when this progressive copper operation expanded their mill. They again selected DENVER Rougher Flotation Machines of the Type "M" design.

Do not overlook the unseen factors in flotation that affect YOUR NET PROFITS. Specify DENVER Flotation. Your economic success is assured by DENVER's proven world-wide leadership in Flotation.

Flowsheet recommendations submitted without obligation. ***WRITE TODAY!***

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Kaiser Steel Triples Drilling Footage

OPERATING IDEAS (*Continued*)

Dipper Design Ups Shovel Output

IMPROVED TEETH PLUS NEW SIDE AND TOP PLATES on dipper increased shovel production as much as 25%, according to the inventor, Robert Frye, shovel superintendent at Marble Cliff Quarries, near Columbus, Ohio.

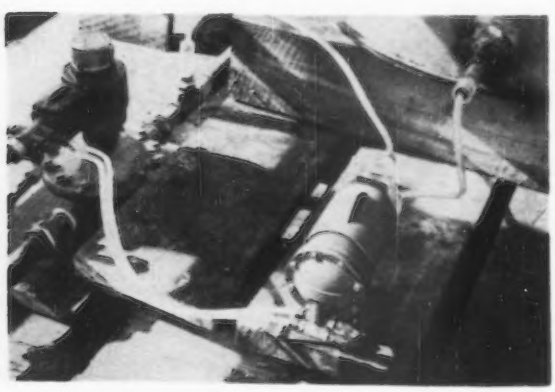
Advantages of the patented wide-tooth design as pointed out by Mr. Frye in "The Marion Groundhog" (Marion Power Shovel Co.'s magazine) are: (1) increased capacity of any dipper size by partly filling in the space between standard teeth, (2) elimination of small stone seepage that normally occurs between standard teeth and thereby saving cleanup time, (3) reduction in digging resistance and tooth wear by tipping small stones to an upright position so that they then act as rollers for larger material.

First set of teeth loaded 383,700 tons of hard Delaware limestone before being built up with hard surface welding. On softer Columbus limestone, a single set loaded 791,000 tons before being replaced, which is considered better than rebuilding.

Teeth, first made for Marion's Type 4161 5½ cubic yd electric shovel, are now being marketed in that size by Marion, and company officials say that the design will be extended to other size shovels when demand increases.

Mr. Frye has also improved dipper design by (1) welding a plate to each dipper side and (2) welding a baffle plate across top of the back to prevent spillage when digging.

The 5½ cubic yd electric dipper shovel takes 1½ minutes (3 passes) to load one of the eight 22 ton rear dump Euclid trucks which then haul material to the plant. During noon hour shovel maintenance, a Marion Type 825 mobile crane equipped with 6,000-lb dropball does necessary secondary breakage.



Water Chlorinator Is Low Cost

NO OUTSIDE POWER is needed for the simple domestic water supply chlorinator devised at Baguio Gold Mining Co., Baguio, Mt. Province, P. I. says A. A. Bakewell, general manager.

Occasional contamination prompted installation of the small unit at the 425 tpd mine and cyanide mill which employs 700 men. It essentially consists of a water meter actuating control valves for diaphragm pump-metering device which injects measured quantity of 1% calcium hypochlorite solution. The unit is entirely automatic (pressure in the water line drives the diaphragm pump) and time for inspection, lubrication, replenishing solution, etc., is about 3 man hours per week. Operating cost (for chemicals) is less than $0.75 for treatment of 32,500 gpd. Purchase and installation cost totaled less than $1,500. Same unit, if required, could handle up to 100,000 gpd without trouble.

Swedes Put In Mine Rail Signals

AUTOMATIC SIGNAL-CONTROL SYSTEM that informs a central control board of defects in cables, rails and switches, indicates train position, and said to be the only one of its kind in the world, has been installed at Sweden's Malmberget Mine's mile-long underground route. Signal lights, designed and installed by Stockholm's Svenska AB Tradlos Telegrafi, are shut off when no train is moving. Once train starts, green lights show that track is clear, yellow lights show movement, and the reds automatically mark off last car when it passes over the light-control trigger.

Kaiser Steel Triples Drilling Footage With Bucyrus-Erie Rotaries

As part of a general modernization of its Eagle Mountain (Calif.) mine in 1955, Kaiser Steel Company added a Bucyrus-Erie 50-R rotary for drilling blast holes in the iron mines of the West.

At Eagle Mountain, the new drill was put to work in the toughest drilling a 50-R had encountered up to that time. So outstanding were the footage records of this drill that within 6 months it was able to replace four churn-type drills. In 1956, a second 50-R was purchased.

Drilling 9⅞-in. holes, the 50-R averaged over three times as many feet per drilling hour as a churn-type drill putting down 9-in. holes. Among the features contributing to this fine performance is the ability of the operator to vary the speed of the 50-R's drill rotation and its down pressure. This means the machine handles all formations, hard or soft, with maximum speed and effectiveness. On the 50-R, hole may be drilled continuously for the full length of the drill pipe — 32 ft. 9 in.

For additional economy, cuttings from the drill hole are piled next to the hole for later use as stemming material. Bits are cooled by compressed air, and compressed air is used to remove cuttings. Fine cuttings are picked up and handled by a precipitator.

When drill pipe is added or removed, manual effort is eliminated by a remote-controlled power-driven drill pipe rack. Through these and other features, the 50-R has eliminated many man hours, considerable equipment, congestion, and cost from the drilling operation.

The features of the electric-powered 50-R are also available in the smaller Bucyrus-Erie 40-R, equipped with either diesel-electric or full electric power. We have detailed, illustrated literature on both models. Write for a copy today.

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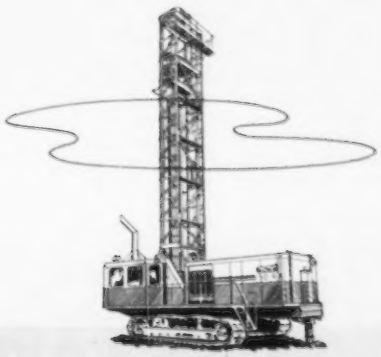
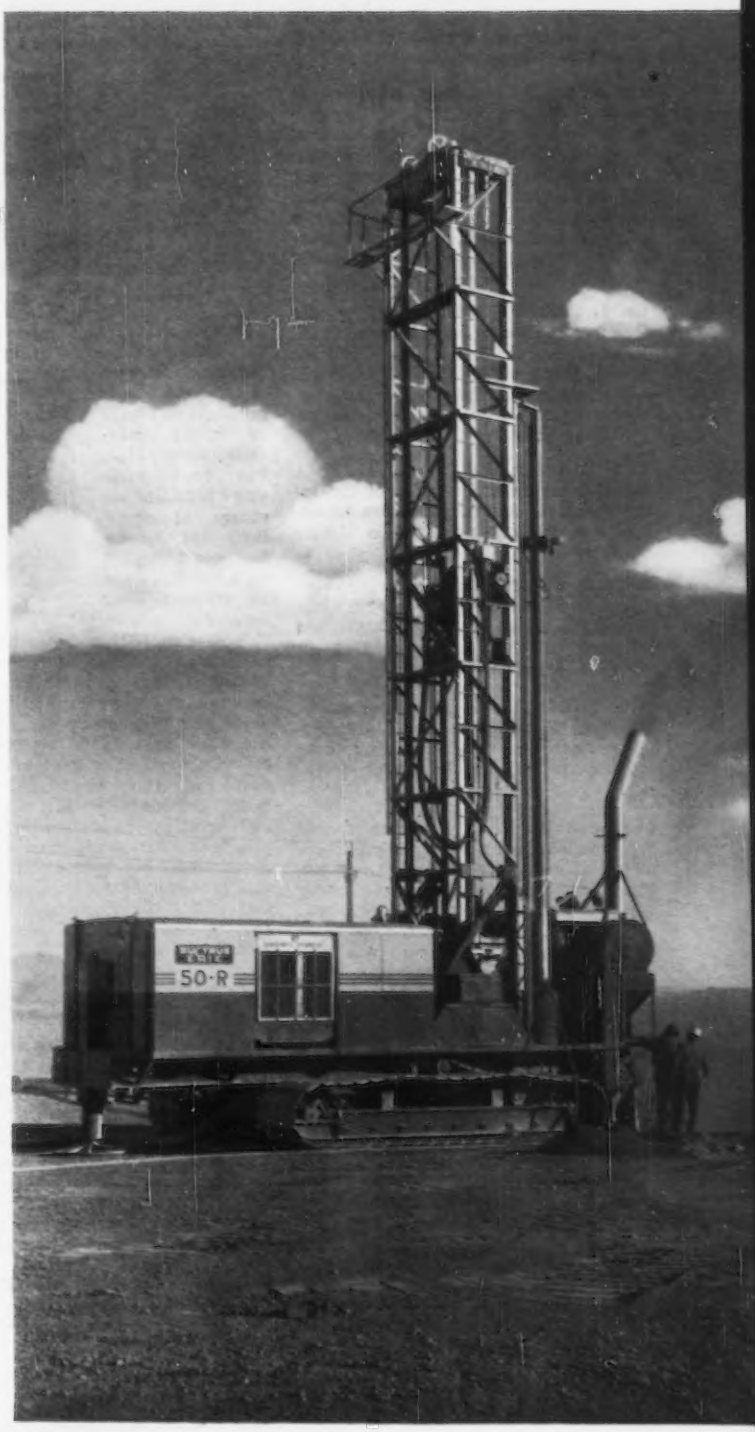




BUCYRUS ERIE SOUTH MILWAUKEE, WISCONSIN

PERSONALS

W. S. Findlay has joined the board of the Consolidated Murchison (Transvaal) Goldfields and Development Co., succeeding K. Richardson, who has resigned.

Odin J. Rudstrom, of Chisholm, Minn., retired Dec. 1, 1957 after 46 years on the Mesabi iron range. He was in the mining engineering department of Oliver Iron Mining division.

Parke A. Hodges, vice president of Behre Dolbear & Co., Inc., mining geological and metallurgical consultants of New York, has been in Sweden, Liberia and Nigeria on professional work for the past three months. At Stockholm, in September, he was official delegate of the Mining and Metallurgical Society of America at the International Mineral Dressing Conference.

Dr. Donald E. Overbeek, formerly with Stauffer Chemical Co. at Chauncey, N. Y. as a research chemist, has joined the Michigan Chemical Corp., St. Louis, Mich. research staff and is currently assigned to the development of new organic chemicals.

C. S. Gibson, Safety Director MAPAO, attended the annual meeting of the International Labour Organization to address the delegates on Safety in Mining Operations.

P. O. Parfitt succeeds H. Skavlem, who has retired as chief engineer at McIntyre Porcupine mines. **J. G. Malkin** becomes mine engineer replacing E. Duxfield, who has also retired.

Wm. J. Daly, mill superintendent at Can-Met Explorations, has been appointed assistant mine manager, retaining responsibility for the milling operation as part of his new post.

Lockwood W. Ferris has been named president of Bonneville Ltd., producers of prilled potash from solar evaporation plant near Wendover, U., succeeding William L. Brady, New York, who was named to the newly created post of board chairman. Ferris, who was vice president and general manager, continues as general manager of the firm. Also elected at the stockholders' meeting in October was **T. H. Talbot,** Boston metallurgist and engineer, as a director.

AIME has elected officers as follows: **Richard C. Cole,** vice president of Vitro Uranium Co., a division of Vitro Corp. of America at Salt Lake City, and formerly with American Smelting & Refining for 20 years, as chairman of the Utah Section, succeeding D. F. McElhattan. **Glen A. Burt,** assistant to manager at the Tooele operations of International Smelting & Refining Co., was named first vice chairman; **Norman L. Weiss,** milling engineer for AS&R, second vice chairman, and **P. H. Ensign,** superintendent of Arthur and Magma mills of Utah Copper division, Kennecott Copper Corp., was elected secretary-treasurer.

Victor Tukkanen, graduate of the Provincial School of Mining, has been appointed Inspector of Mining Claims at Sault Ste. Marie for the Ontario Department of Mines.

John G. Thompson Jr., formerly with Consolidated Mosher Mines, Ltd., has been appointed a safety engineer for Canadian Johns-Manville, Ltd., Quebec.

Newlin

Campbell

The Anaconda Company has announced the following changes of its executive personnel: **Richard S. Newlin,** vice president in charge of mining operations since 1952, has been made vice president in charge of operations. Mr. Newlin has been associated with Anaconda and its affiliates since his graduation from Princeton in 1922 and has held mining engineering and mine supervisory posts in both Arizona and Chile prior to coming to the New York headquarters. **Thomas A. Campbell,** vice president of Anaconda since 1956, has been elected to the newly created post of vice president-Latin American affairs, an additional responsibility. Mr. Campbell is also president of Anaconda Sales Co. and four other subsidiaries. **Charles M. Brinckerhoff** has been elected executive vice president of Andes Copper Mining Co. and Chile Exploration Co., succeeding Mr. Campbell who has held those posts since 1952.

Brinckerhoff

Roy B. Hersey has been appointed state mine inspector by Arizona's Gov. Ernest McFarland, filling the unexpired term of the late Ed Massey. Mr. Hersey was safety engineer for Nevada Consolidated Copper Co. between 1927-1934 and now is vice president of Associated Safety Engineers of Arizona.

Russell C. Fish, Cleveland, has been appointed vice president of the M. A. Hanna Co. which he joined in 1922. Other appointments as vice presidents of the Hanna Coal & Ore Corp. included: **R. W. Whitney, D. N. Vedensky,** and **J. K. Gustafson,** vice presidents of mining operations, research, and geology and development, respectively.

Donald H. Gist has been named plant foreman at M. A. Hanna Co.'s Hunner mine at Coleraine, Minn.

Daniel M. Urich, is now with Cleveland Cliffs Iron Co. at their research laboratory in Ishpeming, Mich. He was formerly at the Jones & Laughlin research laboratory in Negaunee.

A. E. Cameron, mill superintendent at Ozark Ore Co., has been transferred to Lowphos Ore, Ltd., Capreol, Ont., in a similar capacity.

Duane L. Reber, formerly of Orinoco Mining Co.'s Ore Handling department in Venezuela, is now with the Reynolds Metal Co., Kwakwani, Br. Guiana.

Gerald FitzGerald, Chief topographic engineer of the U.S. Geological Survey, retired Sept. 30, after 40 years of service with USGS. He has been succeeded by **George D. Whitmore,** formerly deputy chief topographic engineer.

Adrian Catani, of Hibbing, Minn., was appointed plant foreman at the Hull-Rust crushing and screening plant's operating department of Oliver Iron Mining division. **Rudolph J. Bovitz,** Hibbing, was promoted to plant foreman-maintenance at the firm's Sherman crushing and screening plant.

T. M. Waterland, who recently resigned as mine superintendent of Britannia Mining & Smelting Co., Ltd., has been appointed assistant manager of Upper Canada Mines, Ltd. and now resides at Dobie, Ont. He was 1956 chairman of the British Columbia section of Canadian Institute of Mining.

Vernon F. Daughney, formerly with Heath Steele Mines, Ltd., Newcastle, N.B., has joined Pickands Mather at their new Erie mine concentrator at Hoyt Lakes, Minn.; he is a member of CIM.

J. Thomson has been appointed a director of Roan Antelope Copper Mines, and a member of the London Advisory Committee of Rhodesian Selection Trust, and the Mufulira and Chibuluma companies. Until recently Mr. Thomson was general manager of Roan Antelope.

R. E. Shreve has been appointed superintendent of Kerr-McGee Oil Industries uranium processing mill at Shiprock. He is former assistant mill superintendent.

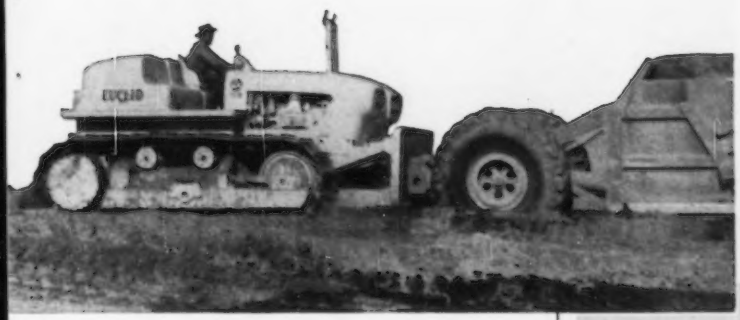
Dr. Paul F. Kerr, leading geologist and professor of mineralogy at Columbia University, was chosen recipient of the K. C. Li Medal, awarded for "meritorius achievement in advancing the science of tungsten." The medal and citation was presented to Dr. Kerr on Oct. 31, at the school's Faculty Club. Dr. Kerr is the third to receive the award founded by Mr. Li, president and chairman of the board of the Wah Chang Corp. and discoverer in 1911 of the world's largest source of tungsten.

Eugene P. Pfleider, professor and chief, division of mineral engineering, at the School of Mines and Metallurgy, Uni-

MORE POWER AND MANEUVERABILITY WITH "Euc" TC-12's ON THE JOB

Euclid "Twin" used for faster production

The dirt work for extension and replacement of runways at Geiger Air Base in Spokane, Washington, called for 400,000 yds. to be moved in 90 days. From over 1200 hours previous experience with his big Euclid TC-12, contractor Neil Degerstrom knew it was his most productive crawler. So, putting his other tractors on less important work, he used the "Twin" for pushloading scrapers to maintain high production on this rush job.



Heavy dozing jobs prove TC-12 work-ability

On a large scale Pennsylvania stripping operation, the Torqmatic-equipped Euclid "Twin" is leveling spoilbanks, cleaning up around the dragline and building access roads. The TC-12's superior work-ability, speed and easy maneuverability show up in getting these jobs done faster and moving from one location to another more quickly.

436 TOTAL HP with
2 ENGINES and
2 TORQMATIC DRIVES

Compare horsepower, weight, speed, drawbar pull, maneuverability, ease of operation, visibility, etc.— the "Twin" is unmatched. Put them all together and you get low cost performance that proves ***Euclids are your best investment.***

EUCLID DIVISION • GENERAL MOTORS CORPORATION • Cleveland 17, Ohio

Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

PERSONALS (*Continued*)

versity of Minnesota, will be visiting professor at the School of Mineral Sciences, Stanford University, from Jan. 1 to June 15. During this period, Dr. D. H. Yardley will be acting chief of the division.

Lester E. Russell, formerly assistant superintendent of reduction of Reynolds Metals Co.'s plant at Troutdale, Ore., is now superintendent of reduction at the company's new aluminum plant being built at Rooseveltown, N. Y. A native Kansan, Mr. Russell joined Reynolds in 1946 as a potroom foreman at Troutdale, after several years' experience at an aluminum plant at Vancouver, Wash. Announcement came from V. G. Kneeskern, project manager and plant manager of the new facility. Mr. Kneeskern also is serving as manager of the Reynolds reduction plant in Virginia until the New York plant is completed.

Russell

R. G. Lindlof, formerly geological engineer with the Atomic Energy Commission in Casper, Wyo., for the past four years, has been appointed chief engineer and geologist of Federal Uranium Corp. Mr. Lindlof, a graduate of Michigan College of Mining & Technology, worked for several years for the Hecla Mining Co. at Wallace, Idaho, as geological engineer and shift boss.

Dr. E. B. Gillanders was promoted to the new administrative post of executive vice president of The Rio Tinto Mining Co. of Canada Ltd. and **H. E. Nelems** became vice president in charge of operations, the post previously held by Dr. Gillanders.

Philip O. Parfitt and **J. G. Malkin,** both members of CIM, have been promoted to the positions, respectively, of chief mine engineer and mine engineer, of McIntyre Porcupine Mines, Ltd., Timmins, Ont.

J. B. Rene Gingras Jr., has joined the staff of Division of Mineral Dressing and Process Metallurgy, Mines Branch, Ottawa. He was formerly with Aluminium Co. of Canada, Ltd., at Wakefield, Que.

George R. Westby and **Mrs. Lucy Bryan McMillin** have been elected to posts, respectively, of treasurer and assistant secretary of Cerro de Pasco Sales Corp. Mr. Westby only recently returned to the U. S. from South America, where for the past two years he was assistant to the manager of Cerro de Pasco's smelting and refining operations in Peru.

Byom. K. Bhattacharyya, of the Indian School of Mines and Applied Geology, Dhanbad, India, attended the symposium on mining research at the Missouri School of Mines. He is on a three-month visit under the International Cooperative Authority program observing mining education in the U.S., with western stops in Colorado, Utah and Tucson, Arizona. He will be due back in India in January.

J. D. Barrington, formerly of the Polymer Corp., Ltd., Sarnia, Ont., and member of the Canadian Institute of Mining, has been appointed president and managing director of Ventures Ltd., Toronto.

Harold S. Hicks, chief geologist at Steep Rock Iron Mines, Ltd., has been made superintendent of the company's new concentration plant.

Richard F. Moe, formerly mine superintendent with White Pine Copper Co., is now with Kermac Nuclear Fuels Corp. at Grants, N.M., as manager of mines.

Osterstock

Eakland

Edward H. Eakland Jr. and **Robert W. Osterstock** have recently become associated as consulting mining geologists, to do work in the field of metallic and nonmetallic deposits, with offices at 700 Newhouse Building, Salt Lake City, Utah. Eakland has done consulting geological work for the past 4 years and was previously with Anaconda Mining Co.'s exploration department for 3 years, International Smelting & Refining Co. for 4 years, Union Mines Development Co. for 2 years and with Iron & Steel division of Kaiser Co., Inc. He is a graduate of Stanford University and a member of AIME, Society of Economic Geologists, and the Geochemical Society. Osterstock, a Dartmouth College graduate, with 2½ years graduate work at Harvard University, has been a consulting geologist for the past year. Previous work includes 2 years as exploration geologist for American Metals Co., Ltd., 4 years as field geologist with U. S. Geological Survey, and 2 years as acting regional geologist. He has also been in charge of DMEA office in Salt Lake City for Utah and Nevada, and is a member of AIME and the American Mineralogical Society.

Correction: In the December issue, *E&MJ* inadvertently transposed the names under the photos of Dr. Fogarty and Mr. Meagher, of Texas Gulf Sulphur Co.

Minex Development Ltd., Vancouver, B.C. has elected **Walter S. Brown,** general manager of Pacific Coast Terminals Ltd., subsidiary of Consolidated Mining & Smelting Co. of Canada Ltd. New directors are **Robert J. Dunlop,** Vancouver, and **J. G. Ortengren,** Tacoma.

Herbert E. Hawks, previously with the Department of Geology and Geophysics at the Massachusetts Institute of Technology, has been appointed Professor of Mineral Technology, University of California, Berkeley.

Hawkes

Officers of the New Mexico Mining Association were elected at the annual meeting in El Paso. **Russell G. Haworth,** vice president in charge of production and resident manager of Potash Co. of America, was elected president. **T. O. Evans**, chief mining engineer for the A.T.&S.F. Railway was elected first vice president, and **A. L. Greslin,** general manager and superintendent, Molybdenum Corp. of America, was named second vice president of NMMA.

The following were elected to serve 3-year terms as directors: **James I. Craig; M. H. Bolton; T. M. Cramer*; T. O. Evans*; Earl H. Miller*; J. C. O'Kelly; L. W. Swent; J. E. Tong; J. K. Richardson*; James H. Russell; E. C. Skinner*;** and **W. Aubrey Smith*.** Elected to serve for one year as members of the Executive Committee were: **T. O. Evans; A. J. Fitch; W. H. Goodrich; A. L. Greslin; R. G. Haworth; J. K. Richardson; J. H. Taylor;** and **A. J. Thompson.** (*—indicates re-election to the board.)

Chile Exploration Co., subsidiary of Anaconda Co., has announced the following promotions at Chuquicamata, Chile: **Joseph C. Allen,** general superintendent of plants; **David Sanders,** assistant general superintendent of plants; **Charles M. Lagergren,** concentrator superintendent; **Francis E. Jones,** assistant to the concentrator superintendent; **Peter B. Hobsbawn,** concentrator general foreman.

Abbott Renick, who is with the Base Metals Branch of the U. S. Bureau of Mines, will transfer, effective Feb. 1, to an assignment as Minerals Attache for the State Department, at New Delhi, India.

Arthur A. Lambert has been promoted to pit foreman at M. A. Hanna Co.'s Enterprise mine. Other recent Hanna Co. promotions are: **Marvin J. Hemp** to pit foreman at the Perry-Carlz; **Alvin D. Grinde** to master mechanic at South

B.F.Goodrich

How Eagle-Picher gets 2 to 3 retreads from B.F.Goodrich all-nylon tires

THE EAGLE-PICHER COMPANY mines and processes lead and zinc ore in northeastern Oklahoma. Inside the mine, dump trucks haul 9.5-ton loads, trailers haul 15-ton loads. Diesels used for outside hauling average 15¾ tons per load. Eagle-Picher used B.F.Goodrich *all-nylon* tires for all these jobs.

The B.F.Goodrich Rock Logger tires above and Universal tires (below left) work inside the mine on a bed of slippery flint rock, yet carry over 3,500 tons a month and give 18 months' service before retreading. Traction Express tires (below right) cover up to 4,000 miles a month on gravel roads. In spite of this rugged work, Eagle-Picher gets as many as 3 retreads from B.F.Goodrich tires!

The B.F.Goodrich *all-nylon* cord body is stronger than ordinary cord materials, withstands double the impact and resists heat blowouts and flex breaks. That's why the B.F.Goodrich *all-nylon* cord body outwears even the extra-thick tread, *can be retreaded over and over!* You get more hours of tire service at lower cost per hour.

Your B.F.Goodrich dealer has a tire for every kind of mining work. Ask him to show you the tires that will save you money or write: *B.F.Goodrich Tire Company, A Division of The B.F.Goodrich Company, Akron 18, Ohio.*

THESE UNIVERSAL tires carry 15-ton loads, often make over 250 trips a month on slippery, razor-sharp flint rock.

ALL-NYLON Traction Express tires work 48 hours a week hauling ore from Eagle-Picher mine. Company uses 3 types of BFG tires.

Specify B.F.Goodrich tires when ordering new equipment

B.F.Goodrich
FIRST IN RUBBER

Your B.F.Goodrich dealer is listed under Tires in the Yellow Pages of your phone book

PERSONALS *(Continued)*

Thompson

Gordon

Woomer

Shoemaker

Gensamer

Agnew

AIME Names 1958 Convention Participants

The AIME has announced the names of recipients of awards to be presented at its annual meeting in New York, Feb. 17-20, among which are: **Dr. John F. Thompson**, board chairman of International Nickel Co. of Canada, Ltd., to receive the Charles F. Rand Memorial Medal for 1958 for "distinguished achievement in mining administration." Joining Inco in 1906 after taking his doctorate at Columbia University's School of Mines, he worked on design and operation of Inco's research lab of the Orford works for investigation of potentialities of Monel, the nickel-copper alloy which had just been developed. He headed the lab in 1918; then established the first technical department. As manager of operations in 1921, he supervised construction of the Huntington Works in West Virginia. After election as assistant to the president in 1928, he succeeded to the offices of director, vice president, etc., and in 1951 as chairman. In 1952 he relinquished the presidency. **J. Roy Gordon**, of New York, executive vice president of International Nickel Co. of Canada, Ltd., and International Nickel Co., Inc., will receive its James Douglas Gold Medal for 1958 "for distinguished contributions to process metallurgy in the field of smelting and refining of nickel, and metallurgical improvements in nickel recovery." Formerly a research metallurgist for M. J. O'Brien, Ltd., before going in 1929 to the Ontario Research Foundation, Toronto, where he became assistant director of metallurgy, he joined Inco in 1936 as director of the Research Department.

J. W. Woomer, of Pittsburgh, and head of the consulting firm of J. W. Woomer & Associates, has been nominated by the Society of Mining Engineers, of the AIME, as president-elect of SME for 1958. Mr. Woomer would take office in 1959, succeeding Stanley D. Michaelson, of Salt Lake City, chief engineer, Western Mining Division, Kennecott Copper Corp. **Abbott H. Shoemaker,** vice president and general manager of Homestake Mining Co., Lead, S.D., has been named to receive the Daniel C. Jackling Award and to deliver the Lecture. Mr. Shoemaker took his degrees from the University of Arizona and attended the University of Colorado. Prior to joining Homestake, he was associated with Triumph Mining Co., Triumph, Idaho; Elizalde & Co., Manila; Ahumada Lead Co., Chihuahua, Mex.; and Old Dominion Co., Globe, Ariz. AIME's board cited him "for leadership in efficient mine operation, resulting in profits under a fixed gold price in spite of inflationary costs, and for his lecture, "Planning for Deep Mining at Homestake." **Dr. Maxwell D. Gensamer,** of Columbia University, will be the Howe Memorial Lecturer for 1958, under the auspices of the Iron and Steel Division of the Metallurgical Society. He is the author of many published technological articles and of the book, "Strength of Metals Under Combined Stresses." **Allen F. Agnew,** director of South Dakota Geological Society and professor of Geology at State University of South Dakota, will be recipient of the Robert Peele Memorial Award for 1958. The award was won for a paper on "Application of Geology to the Discovery of Zinc-Lead Ore in the Wisconsin-Illinois-Iowa District."

Agnew and Morton mines; **Lewis E. Pochucha,** Goodland, to plant foreman at South Agnew and Weggum mines; **Bernard Forss,** Nashwauk, to general pit foreman at South Agnew; **John Gernert,** Hibbing, to assistant superintendent at the South Agnew and Morton; **Gordon L. Campbell** to plant foreman at the Perry mine.

O. Vispi, formerly engineer at Pickands Mather & Co.'s Cary mine at Hurley, Wis., is now mine engineer at the Scranton mine in Hibbing, where he replaces **Paul Willard,** who has been transferred to Tioga No. 2 mine.

Arthur M. Anderson, assistant superintendent at Tioga No. 2, has been appointed superintendent.

Harland Stetson, of Crosby, assistant superintendent in the Cuyuna district, has been appointed district mine superintendent for PM's Cuyuna range mines. Reserve Mining Co. has announced the advancements of **Henry D. Blanchard,** assistant superintendent of the power plant, to superintendent. **Henry M. Lueck** to general foreman of the power plant, and **Warren E. Johnson** to shift engineer.

Russell G. Haworth, vice president in charge of production and resident manager at Potash Company of America, was elected to the board of directors at the annual stockholders' meeting in Denver, Oct. 16. He joined PCA as mine engineer in 1942. A graduate of the Harvard Engineering School, he started his career as a miner with Homestake Mining Co.; later as superintendent of a gold mining property in the Philippines with Nielson & Co. Shortly before World War II he returned to the U.S.A., held mining positions with Magma Copper Co., Anaconda Copper Co., and for Nielson & Co. His experience includes mining of copper, coal and chrome properties.

L. Stevens Condor, formerly assistant mine engineer at PCA, was named to position of staff engineer. A Colorado School of Mines graduate, he joined PCA in 1955, prior to which he served as mine engineer for several eastern Kentucky coal companies.

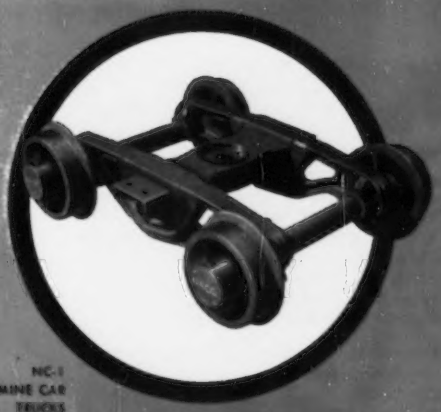
Matt Laughland has been promoted to mine maintenance foreman at Southwest Potash., which he joined in 1952 as a maintenance man in the mill department, transferring to a mine maintenance post shortly thereafter.

Randal H. Taylor was appointed mine superintendent for Duval Sulphur & Potash Co.'s Carlsbad operation. For the past three years he served as assistant chief engineer for Climax Molybdenum Co., prior to which he was with Independent Coal & Coke Co. at Castle Gate as assistant superintendent, and as assistant chief engineer for the Kaiser Steel Corp., both at Castle Gate, Utah.

John B. White, Jr. has been appointed chief engineer for Western Knapp Engineering Co., San Francisco district. Mr. White has established residence in Palo Alto, California.

Philip B. Dettmer has been named staff metallurgist for M. A. Hanna Co. with headquarters at Cleveland. He had been with C. F. Braun, an engineering and construction firm.

Byron Miller, of Bismark, Mo., has been promoted to mine captain, and **Raymond Kernan,** of Irondale, Mo., to assistant mine captain at the Iron Mountain mine of Ozark Ore Co.



NC-1 MINE CAR TRUCKS

NATIONAL CUSHIONING DEVICES

7 years and 460 cars later

Olga Coal Company still 100%

NATIONAL-EQUIPPED

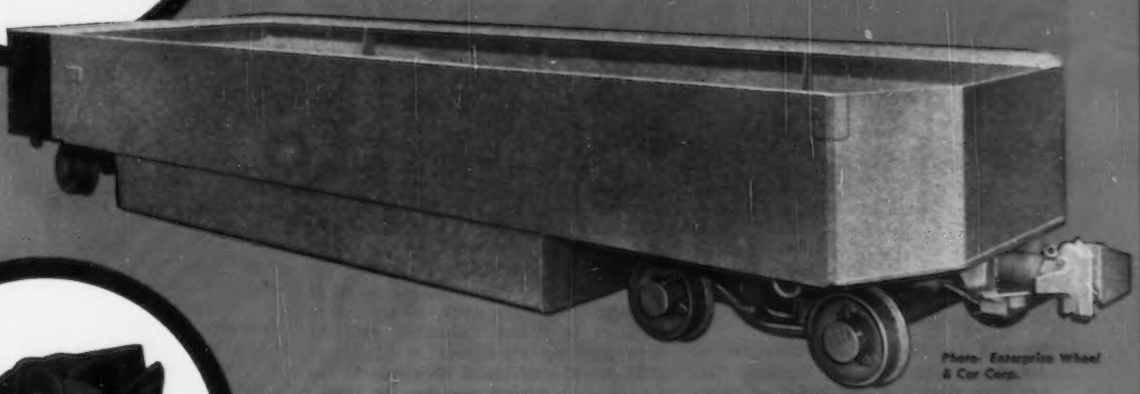


Photo: Enterprise Wheel & Car Corp.

WILLISON AUTOMATIC COUPLERS

NACO STEEL WHEELS

In 1951 Olga Coal Company bought 300 coal cars equipped with National NC-1 Trucks, National rubber cushioning devices, Willison Automatic Couplers and Naco Steel Wheels.

Based on experience with the 300 original cars, Olga Coal purchased an *additional* 120 cars. And now Olga Coal has placed a *third* order for 40 more cars. This brings Olga's modern fleet up to 460 units—*all 100% National-equipped.*

This is typical of the swing to National-equipped mine cars—for safety . . . for longer life and lower maintenance . . . for lower per-ton mining costs.

NATIONAL MALLEABLE AND STEEL CASTINGS COMPANY

Established 1868 — *Cleveland 6, Ohio*

WILLISON AUTOMATIC COUPLERS • RUBBER CUSHIONED UNITS • NACO STEEL LINKS and SWIVEL HITCHINGS • MINE AND INDUSTRIAL CAR TRUCKS • NACO STEEL WHEELS

CANADIAN SUBSIDIARY *National Malleable and Steel Castings Company of Canada, Ltd. • 128 Simcoe St. • Toronto 1, Ontario*

PERSONALS *(Continued)*

Wardlaw

Little

F. A. Wardlaw Jr., general manager, and **James J. Little,** assistant to the general manager, International Smelting & Refining Co., Salt Lake City, retired as of January 1, 1958. Mr. Wardlaw Jr., a Columbia University graduate, had been with Anaconda Co. or subsidiaries for nearly 35 years. He is vice president and director of United Park City, a director of American Zinc Institute and a past national director of American Mining Congress, as well as president of North Lily Mining Co. Mr. Lillie, who first joined the company in June 1916 as a test engineer, was an assistant professor of geology at the Colorado School of Mines from 1921-25. Since then he has served as an officer and director of some 26 mining companies in Utah, California and Nevada in which Anaconda has had interests. As manager of the Mountain City property, Mr. Lillie and his staff developed the first slot system of square set stoping.

F. L. McDonald, assistant manager, Florida Phosphate division, American Cyanamid Co., has returned to Canada, as plant manager at North American Cyanamid Ltd.'s Niagara Falls, Ont., cyanide reagent facility. He had been in South America prior to joining American Cyanamid in Brewster, Fla. several years ago.

Howard Lee Young, vice president of American Zinc, Lead & Smelting Co., has been elected to the board of directors to fill the vacancy caused by the recent death of Mr. Erle V. Daveler, who was a director and vice president.

Albert E. Long, a U. S. Bureau of Mines research engineer at the Bureau's Rare and Precious Metals Experiment station at Reno, has been given a superior performance citation carrying with it a cash award of $500, in recognition of his development of a technique for taking advantage of the varying hardness of diamonds that is saving the domestic mining industry an estimated $4-million a year.

Ivan H. Sloane, safety director of the Mining Association of British Columbia, was elected general chairman of the Mining Section of the National Safety Council at the annual meeting of the National Safety Congress in Chicago Oct. 21 to 25. Other officers elected: **S. E. Sharp,** Tennessee Copper Co., first vice chairman; **C. R. Neil,** Bethlehem-Cornwall Corp., Pa., second vice chairman; **Roger F. Thew,** safety director at Steep Rock Iron Mines, Atikokan, Ont., third vice chairman; **John A. Johnson,** U.S. Bureau of Mines, Washington 25, D.C., program chairman.

OBITUARIES

Albert St. Vincent, 75, former general superintendent for Oliver Iron Mining Division, U.S. Steel Corp., died in Hibbing, Minn. on Nov. 13.

F. R. Friedley, 54, comptroller of Oliver Iron Mining Division, U.S. Steel Corp., died suddenly in Salt Lake City, Utah, on Nov. 1.

Daniel Emmett Coughlin, 67, of Bovey, Minn., retired mine superintendent for Pickands, Mather & Co., died in the Itasca County Hospital at Grand Rapids on Oct. 25.

R. E. Neelands, 48, Minerals Special list, Mineral Resources Division, Department of Mines and Technical Surveys, Ottawa, died suddenly at his home in Ottawa, Sept. 24. Prior to joining the Department in 1945, he had been with Beattie Gold Mines, Opemiska Copper Mines, Macassa Mines, Dome Mines, and other mining companies. He was a member of the Professional Institute of Canada, and The Canadian Institute of Mining and Metallurgy.

F. Wm. Guernsey, one of Western Canada's top mining engineers, died at his home in Vancouver, late last year, after a lingering illness. Soon after graduation from the University of Toronto in 1895, he became associated with Neepawa Gold Mining Co., followed by a long career in mining, including placer mining in the Klondike, ore buyer for Consolidated Mining & Smelting Co. of Canada, and, since 1919, as consulting engineer in British Columbia. He had been president throughout its life, from 1933 to 1954, of Island Mountain Mines Co., a gold mining operation at Wells, B.C. He had retained his directorships in Pioneer Gold Mines of B.C., Pacific Nickel Mines, and Ecstall Mining Co.

Charles H. Foreman, 70, retired chief engineer of Hecla Mining Co., died in a Wallace, Idaho hospital Nov. 22.

Sir Ernest Oppenheimer, 77, last of the original founders of South Africa's mining industry, died suddenly at his home in Johannesburg, Nov. 25. He had suffered a stroke in September. Sir Ernest's title dies with him and his son, Harry Oppenheimer, a member of the South African Parliament, will inherit his fortune, estimated at $183-million. Sir Ernest was chairman of the Anglo-American Corporation group of companies, the De Beers group and the Rhodesian Anglo-American group. Through various companies he controlled the world diamond trade. He was also a leader in the development of the Orange Free State gold fields in South Africa, at which time his companies had long been among the major seven groups on the Witwatersrand. In 1917 he formed the Anglo-American Corp., and in 1920 the Anglo-American formed the Consolidated Diamond Mines of South West Africa. By 1929 he gained control of the De Beers Corp., created by Cecil Rhodes, and 95% of the world rough diamond trade. Sir Ernest was knighted in 1921 for service to the British Commonwealth.

Edward B. Greene, of Cleveland, honorary chairman of the Cleveland Cliffs Iron Co. board, died Oct. 20. After a career in banking, he became president in 1933 and was made chairman of the board and chief executive officer in 1947 and honorary chairman in 1954. Mr. Greene had been a director of several other companies, including Jones & Laughlin Steel Corp., and the New York Central RR.

Charles H. Foreman, 70, retired chief engineer of Hecla Mining Co., died suddenly Nov. 22 in a Wallace, Idaho hospital. A University of Idaho graduate, Mr. Foreman joined Hecla in 1909 and served as chief engineer from 1918 until his retirement in 1949.

Clair O. Evans, 64, who had been with Phelps Dodge Copper Products Corp. for 41 years, died Dec. 8 at Wickersham hospital in New York after a long illness. In his last capacity as metallurgical engineer, he was in charge of research and development of non-ferrous alloys for use in condensers and heat exchangers.

LETTERS

Dear Sir,

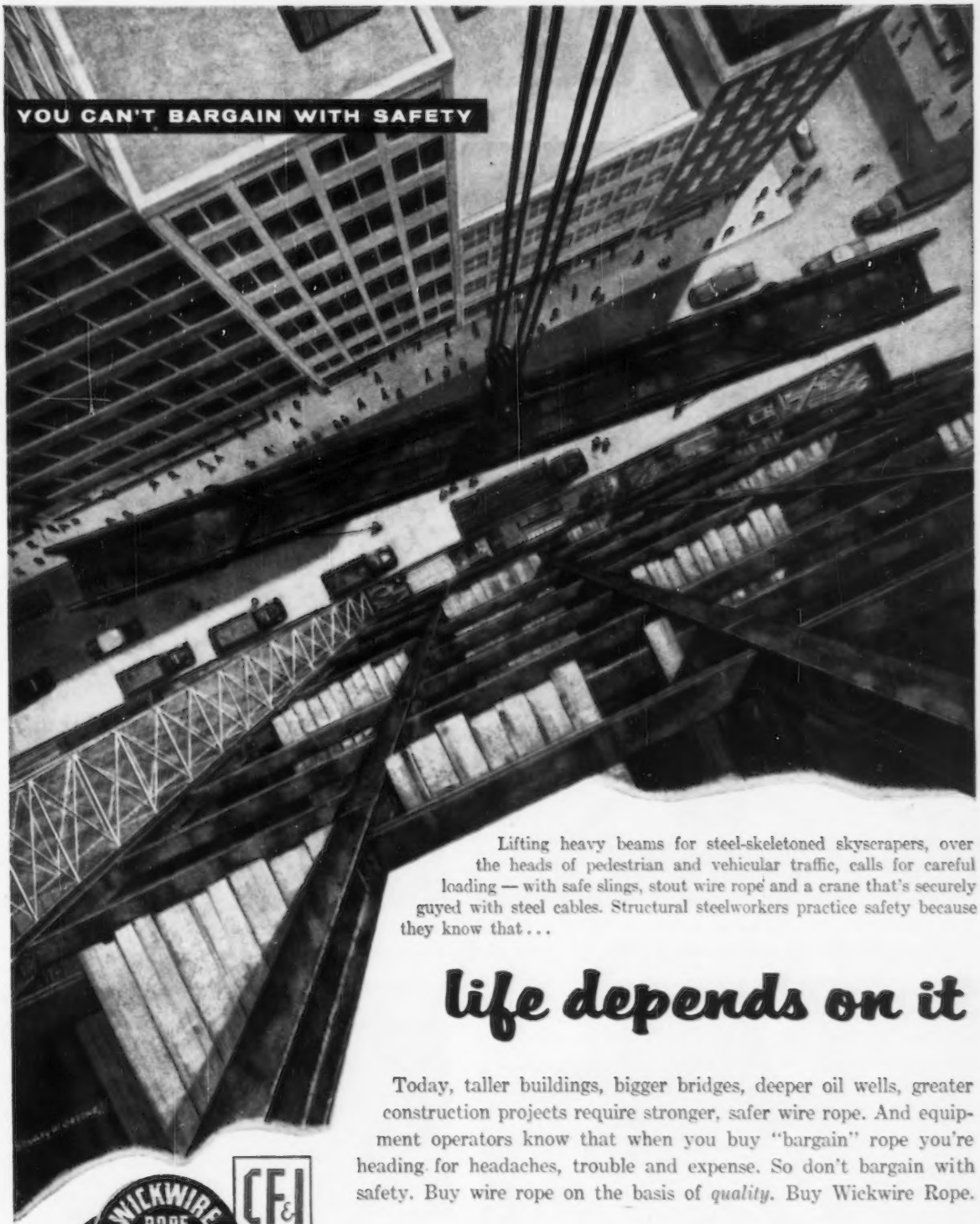
On page 81 of the November issue of the *Engineering and Mining Journal* in the caption of a photograph of Professor Kihlstedt and myself it is stated that I am to be the chairman of the 1960 International Mineral Dressing Congress which is to be held in London.

The publication of this statement, which is incorrect, has caused me some embarrassment. The facts of the matter are as follows. At the Stockholm Congress I represented the Institution of Mining and Metallurgy and at the concluding banquet, after Professor Kihlstedt had announced that the next congress was to be held in London, I made a short speech to welcome those present to a congress in 1960. I endeavoured to make it clear that I was speaking only on behalf of the Council of the I. M. M. who will be responsible for the organization of the congress. I am a member of the organizing committee but it had not yet been decided who will preside at the congress.

While I realize that the incorrect statement which you have published arose from a pardonable misunderstanding, I cannot let it pass without disclaiming it.

Yours truly,
Cyanamid of Great Britain Limited
J. E. Denyer

NACO STEEL WHEELS



Lifting heavy beams for steel-skeletoned skyscrapers, over the heads of pedestrian and vehicular traffic, calls for careful loading — with safe slings, stout wire rope and a crane that's securely guyed with steel cables. Structural steelworkers practice safety because they know that . . .

life depends on it

Today, taller buildings, bigger bridges, deeper oil wells, greater construction projects require stronger, safer wire rope. And equipment operators know that when you buy "bargain" rope you're heading for headaches, trouble and expense. So don't bargain with safety. Buy wire rope on the basis of *quality*. Buy Wickwire Rope.

5696

WICKWIRE ROPE — A C.F.&I. PRODUCT

CF&I

LOOK FOR THE YELLOW TRIANGLE

PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
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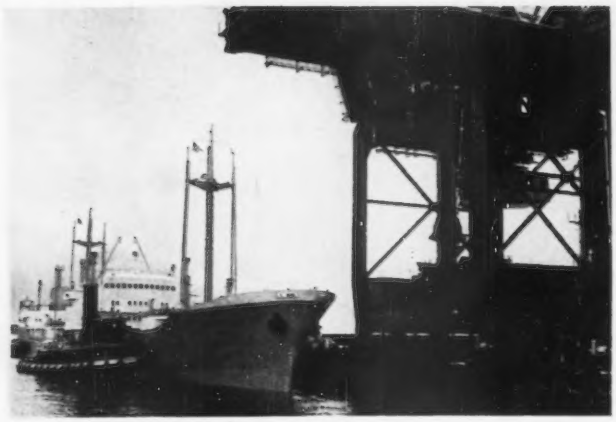
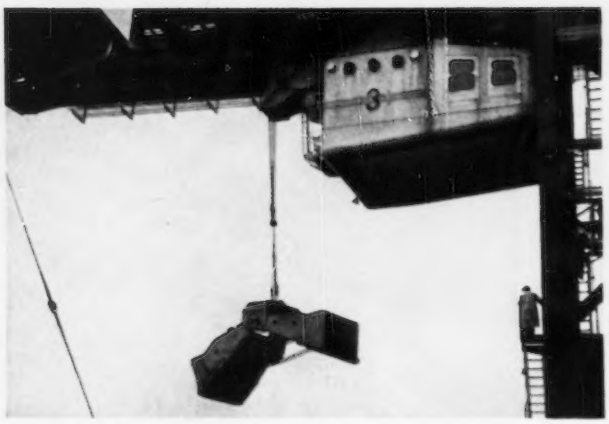
Faster than a



Unloaders handle vessels on both sides of finger-type pier.



Each unloader can take out 18 tons of ore every 45 seconds.

Each unloader has movable hopper to transfer ore to belt conveyers or direct to railroad cars on pier.

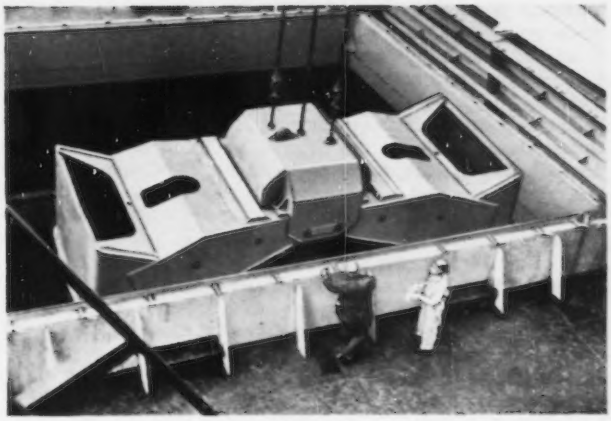
Twin belt conveyers, 48" wide and 1080 feet long move ore at 600 feet a minute to a carloading house.

Electronic weighing, accurate to the pound, is recorded on printed cards.

After exact weighing, ore is loaded into thoroughly flushed out cars.

ton a second

Unloaders are "slewing jib" type. 190-ton gondola moves back and forth on trolley and rotates in full circle.



For greater efficiency, light weight buckets use mechanical principle to dig ore on a plane instead of "trenching" back and forth, and clean out holds without auxiliary equipment aboard ship.

Chesapeake and Ohio's new bulk cargo unloading facility at Newport News on Hampton Roads, Virginia, is now giving ore importers and ship operators the finest service on the Atlantic coast. Its 1191-foot pier accommodates the largest ore carriers afloat. Three mobile unloaders, operating with unprecedented flexibility and speed, work two ships simultaneously or three holds of a single large ship and handle two types of ore at the same time. Various sizes of buckets, changeable in less than five minutes, are available for different types of ore and vessel. In a matter of minutes, ore carried on twin belt conveyors is loaded, after electronic weighing, into open top cars for swift Chesapeake and Ohio rail movement inland.

Ship operators like the quick access to the new C&O pier at Newport News and the faster turn-around. Ore importers like C&O's ready car supply and prompt delivery of their cargoes.

* * *

Chesapeake and Ohio's World Commerce Department assists exporters, importers, forwarding agents, steamship operators on all matters relating to rail and ocean shipping of import ores and other overseas and intercoastal cargoes.

Write for illustrated folder showing in detail the operation and advantages of C&O's new bulk cargo unloading facility.

Chesapeake and Ohio Railway

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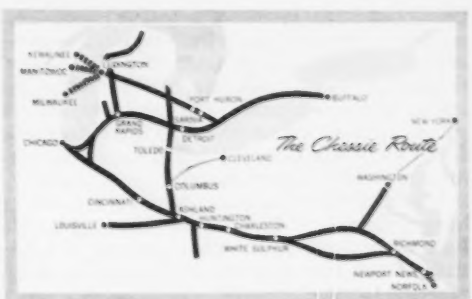


WASHINGTON IMPACT

Highlights

WORLD MARKET SCRAMBLE—Washington's focus on tariffs and trade policy as Congress reconvenes this month is a political one. So much so, in fact, that some metals and minerals experts are worried for fear underlying economic problems of mines and mills will be blurred or distorted.

The important long-range concern of both producers and processors is almost classically basic, this argument runs. It is a case of supply and demand. In this sense, many domestic metal and mineral industries share the same pinch that has hit their foreign counterparts the world over since the war—expanding production and a post-war slump in demand which has created a hectic scramble for softening world markets for most of the older metals and minerals.

All of this is not to say that tariffs and trade should not be controlled or "managed," to use the economists' phrase. A top-level Interior Department metals expert just back from the General Agreement on Tariffs and Trade (GATT) negotiating session at Geneva puts it this way: "Political thinking must not be allowed to unduly influence the economics of the mining and processing industries."

POLITICS AND ECONOMICS—The two don't always go hand in hand. The immediate political concern of domestic industries, Congress, and the White House is the extension of the Reciprocal Trade Agreements Act, up for review in Congress early this session against powerful protectionists' opposition which has been building up for years. The Administration is firmly committed to a moderately liberal over-all trade program which hinges on the basic trade agreements legislation, not only to protect $20-billion of U.S. exports, but to help strengthen the economies of allies it feels an increasing need for, particularly in light of Russia's recent declaration of economic war on the Free World.

To continue liberal international trade policy, the White House is willing to retreat from its basic position, commodity-by-commodity, offering limited protection to scattered domestic industries in order to prevent a concerted protectionist revolt in Congress from overthrowing the Trade Act itself (see story this page.)

A NEW RUSSIAN THREAT—Yet, if Russia, together with its satellite nations, really wanted to knock the already shaky commodity markets into a further flap, it could dump on the Free World huge supplies of such materials as steel, tungsten, tin, titanium, manganese, copper and others, which could conceivably break prices and at least temporarily wreck the delicate supply-demand balance altogether.

In fact, say some commodity people in Washington, there are indications that Moscow is already leaking increasing amounts of several commodities into west. They cite shipments, which are hard to confirm, of 700 tons of tin a month, which already has helped throw the International Tin Agreement into new production controls. Unknown quantities of steel, titanium and manganese are also being leaked; tungsten and copper could follow.

The answer, this school of economic thought argues, is for the older, basic metals and minerals producers to join together in a concerted research drive to find new uses for their products, new alloys and new products for new markets.

DRASTIC SOLUTION—The logical conclusion of such reasoning is a much freer trade program. Proponents concede it would hurt for awhile, and should be effected gradually. But these people fear the alternative is a breakdown of world trade generally, with Congressional log-rolling setting higher tariffs and quotas on one commodity after another until the nation became almost totally isolated economically—which could be disastrous because of the physical impossibility of domestic self-sufficiency in all necessary materials.

What makes this thinking important is not so much the fact that it is being proposed in Washington—it is, afer all a classic argument for freer trade. The significant thing is that it is being expressed by metals and minerals men who, though now serving in Congress or the executive agencies, represent business views from their own personal experience.

Trade Policy Disputes Highlight '58 Session

COMPROMISE IS THE KEY to Washington's battle of trade policy under way in Congress this session. It marks proposals and actions already made by the Administration, the Tariff Commission, State and Commerce Department, and the House and Senate traditionally arrive at their conclusions by the same path.

Here are some of the more significant developments on the trade front:

White House program—The Administration's proposed trade program centers around extension of the basic Reciprocal Trade Agreements Act, up for review and extension this year in face of strong protectionist sentiment in Congress. The President has asked:

1. A five-year extension of the act;
2. Tariff-cutting authority of 5% a year, with permission to reduce duties up to 25% over three, four, or five years;
3. Additional power to cut ad valorem rates currently less than 50% of the value of the imported item by as much as three percentage points, instead of a 25% limit;
4. At the same time, authority to raise tariffs to 50% of their 1934 rates instead of the lower rates applying in 1945.
5. Quicker escape clause action on cases where the Tariff Commission has made a peril-point finding, with the escape-clause petition following automatically instead of waiting for GATT negotiations.

The White House also will ask approval of U. S. membership in the controversial proposed International Organization for Trade Cooperation (OTC), review of customs and anti-dumping laws and procedures.

The package is obviously an attempt to keep over-all national trade policy on a moderately liberal keel, while assuring domestic producers of adequate safeguards against increasing import competition.

Agency Shift—As another part of the Administration's compromise, it is shifting trade program administration from the State Department to the Commerce Department, where many businessmen feel they have a more sympathetic ear for their problems. Commerce Secretary Sinclair Weeks will head a new cabinet-level world trade advisory committee set up to review GATT agreements, Tariff Commission actions and over-all policy. Assistant Commerce Secretary Henry Kearns has been put in charge of intra-agency group, a 60-man industry advisory committee on trade problems.

The advisory group, representing large and small businesses on both sides of the trade argument, held its first meeting in Washington last month, but did not make any firm recommendations or endorsements of policy. It will be used as both a forum for industry views and for the Administration to sell its ideas to business.

On Capitol Hill—Protectionist sentiment in Congress, supported by industry

groups such as O. R. Strackbein's nationwide Committee of Industry, Agriculture and Labor on Import-Export Policy is led by individual Congressmen who represent geographically scattered industries who favor further trade restrictions. Their announced goal is to write into the trade agreements law new tariff and quota-setting power for the Tariff Commission, reduced authority for the President and State Department negotiators to cut tariffs through GATT, defeat of OTC, tighter anti-dumping and customs laws, and easier relief on grounds of defense-essentiality. Otherwise, this group has said, it will either write specific quotas into the law on the floors of the House and Senate or defeat the bill.

On the liberal-trade side, Rep. Hale Boggs (D-La.), chairman of the House Ways and Means Foreign Trade Policy Committee, will lead the fight for the White House program, even though it is less than pro-free traders hopes for. Boggs has recently concluded voluminous hearings and reports on over-all trade policy, is now preparing a strong pro-liberal trade report to support extension of the reciprocal trade agreements law.

More Compromises—The quid-pro-quo character of the fight is further indicated by other recent developments. By approving higher duties recommended by the Tariff Commission on safety pins and clothespins, the White House is showing a willingness to grant some relief in order to protect the basic law itself. This further indicates lead-zinc imports will get higher tariffs, at least on metal forms, if not on ores and concentrates, but quotas are a slim possibility.

Here again, a split industry helped the cause of compromise. Only smaller domestic producers favored maximum tariffs for both ores and metal at recent Tariff Commission hearings, with processors favoring higher tariffs on the metals they compete with than the ores and concentrates which they buy in significant quantities abroad.

Correction: Confusion over the difference between proposals for lower tariff boosts on ores and concentrates and for higher rates on metal may have arisen to misunderstanding of the position taken at Tariff Commission hearings by the National Zinc Co., and Matthiessen-Hegeler Zinc. Co., as reported in last month's Washington Impact. These two companies favored maximum tariff increases on slab zinc, but proposed that duties on ores and concentrates, if raised at all, be raised by only half as much. They opposed quota limitations.

The give and take of trade politics is shown also by the fact that the U.S., for example, is considering suspending import duties on nickel as a concession to Canada in return for the pending imposition of higher tariffs on lead and zinc, despite some attempts to develop a domestic nickel industry here, because of the importance of both nickel and lead and zinc to our leading trading partner, Canada.

Labor This Month

LABOR'S CLOUDY NEW YEAR—The signs for 1958 are ominous to organized labor. Economic trouble markers show up for the first few months, at least. Unemployment is expected to keep climbing—Mine-Mill's economists predict a 5-million jobless total before mid-year. Bargaining is going to be tough. The business slowdown will help solidify employer resistance to union demands. And, corruption and legislative troubles show up strong. The McClellan Rackets Investigating Committee anticipates hearings all through the year. And, concurrently, Congressional Labor Committees will hold hearings on proposed labor legislation; most of it designed to wipe out racketeering and therefore leaning toward tighter strings, on union operations.

TAFT-HARTLEY'S NEW FACE—Just about everybody—unions, management and the Eisenhower Administration—want to alter the Taft-Hartley law in 1958. But that's as far as the agreement goes. All three sides are at odds on most of the proposed changes. The unions do agree with labor Secretary James P. Mitchell's plans for disclosure of health and welfare and pension funds to the public glare. And, they see eye-to-eye on some minor amendments affecting construction unions. But where Mitchell wants curbs on picketing and secondary boycotts, the unions want looser rules on union security. Employers, in turn, don't like the welfare proposal because it would open the books of employer-financed funds. And, some want to apply more anti-trust and political spending curbs on labor.

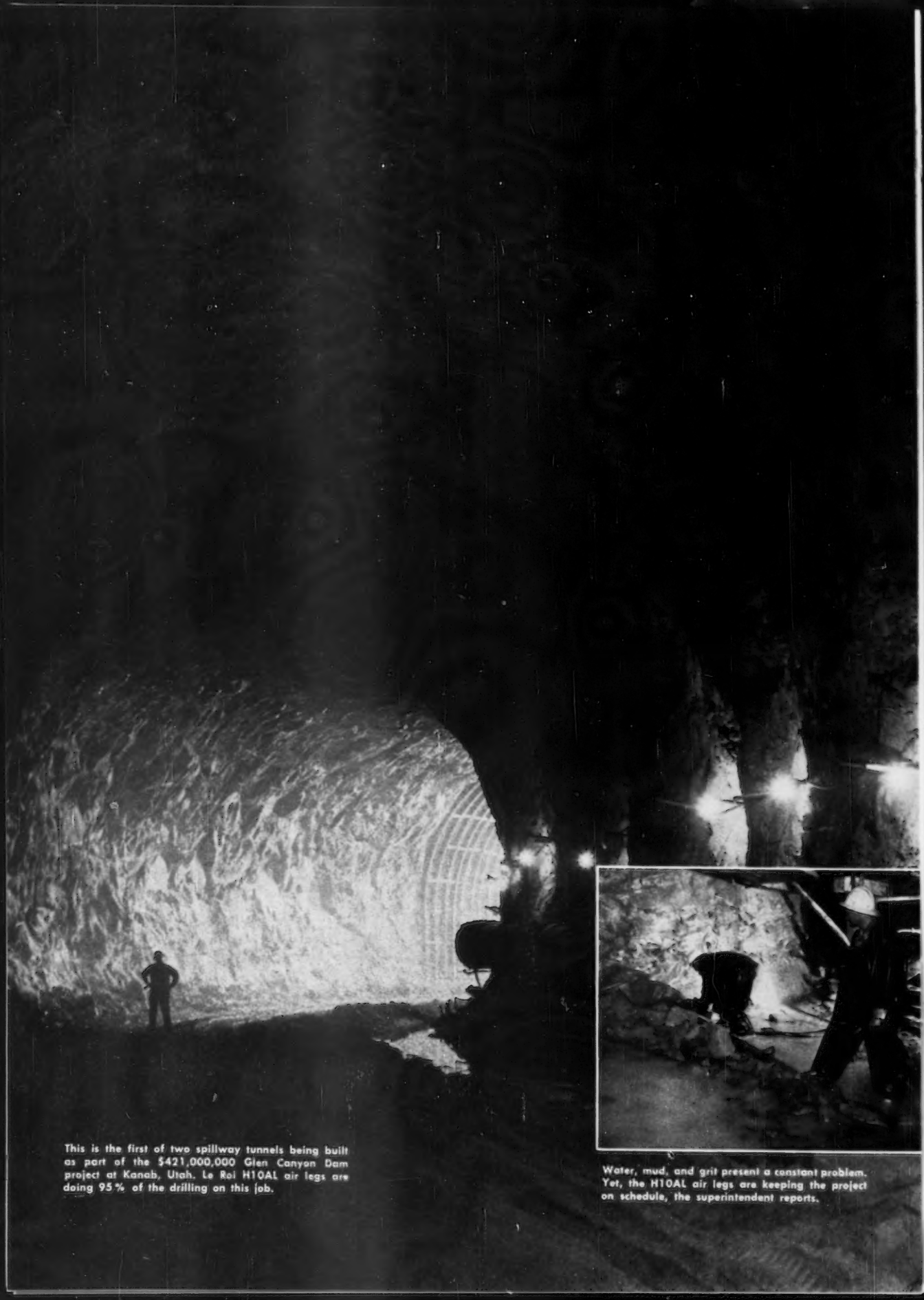
But, here's one case of where there's smoke, there's not necessarily a fire. It is more than likely that Congress will not enact any new labor legislation this session. There are more reasons than just resistance to any single set of amendments. Certainly, the labor law will be discussed to the hilt in Congressional hearings, but there probably won't be any time to vote on amendments. This is an election year and Congress normally closes up shop early.

An outside chance for new union legislation would require a shift in the wind. This is possible, particularly in the spring when collective bargaining moves into full speed. At that time, the United Auto Workers will meet the auto industry on terms for a new contract. If the UAW's Walter Reuther sticks with his stated demands— a substantial pay raise and shorter work week—there could well be a strike. And a strike—if it's long and tough—could raise the Congressional blood pressure to a point where they'll do more than talk about T-H.

LABOR'S UNMERGED UNIONS EXPAND—The total number of union members in unions not affiliated with the AFL-CIO has been more than tripled with the addition of three unions tossed out of the AFL-CIO on corruption charges. The three—the International Brotherhood of Teamsters, Bakery Workers, Laundry Workers—have a total membership of more than 1.5-million. These new independents join those still remaining from the expulsion of the ex-CIO on Communist charges—led by the Mine-Mill and Smelter Workers and the United Electrical Workers.

These unions now have the makings of a strong new labor federation—if they choose. However, the signs do not point to a formal alliance. If there's any immediate team-up, it's likely to be a mutual aid pact between the Teamsters and the Mine-Mill. The first attempt at a working arrangement between the nonferrous union and the trucker's western conference was broken up before it got under way by the AFL-CIO at the time of the merger two years ago.

For the time being, no new overtures to other ousted unions will be made by the Teamsters. Currently involved in legal troubles, their leaders aren't anxious to stir up more difficulties by arousing the AFL-CIO wrath. But, if the Teamsters' James Hoffa clears his court trials and stays on as president of the trucking union, look for attempts at building up a new labor federation. This could include all independents, even John L. Lewis' United Mine Workers which, at different times voluntarily withdrew from the AFL and the CIO. If this alliance is formed, it could be the nucleus for a membership war with the AFL-CIO.



This is the first of two spillway tunnels being built as part of the $421,000,000 Glen Canyon Dam project at Kanab, Utah. Le Roi H10AL air legs are doing 95% of the drilling on this job.

Water, mud, and grit present a constant problem. Yet, the H10AL air legs are keeping the project on schedule, the superintendent reports.

20 Le Roi H10AL Air Legs cut through 1750 ft. of solid sandstone without a major breakdown

Le Roi Air Legs Conquer Tough Tunnel Job

"Average downtime per machine is only 3 hours per month under the roughest conditions I've ever seen," says tunnel superintendent.

Not one major breakdown — not a single replacement needed since the start of operations in October, 1956. That's the endurance record of the Le Roi H10AL air legs being used to drill water diversion tunnels through solid sandstone.

They've been at it six days a week, averaging 15 ft. a day, under extremely severe operating conditions — and show no signs of letting up, according to the tunnel superintendent. It's rough on men and machines.

Two Giant Tunnels

The job involves the drilling of shot- and roof-bolt holes in two tunnels 2740 and 2900 ft. long for the Glen Canyon Dam on the Colorado River. Each will be 43½ ft. wide at the upper end and 46½ ft. wide at the lower.

Drillers work on a specially-built five-deck jumbo rig, mounted on wheels. Air legs, using 1 in. drill steel, are used on all five levels. Holes are drilled about 18 ft. into the face, at speeds of four minutes per hole.

Tough Going

Actual drilling cycles average four hours per day. But it's tough going every foot of the way. Mud and bad water seepage — 30,000 gallons pumped out daily — make drilling even tougher.

Grit, grime, and water cover everything. The abrasive sand found in the tunnel is equal to 60-grit stone — and gets into everything. Yet, the average replacements on the machines have been springs, seals, bushings, and leather gaskets. Mechanical parts are still intact.

The simple design of the Le Roi air legs has been a real time- and money-saver. "We can tear down and re-assemble a unit in minutes," the superintendent explains. "Average monthly downtime has been 3 hours per machine. Cost of maintenance per machine totals only $20 per month." Like the internal parts, the automatic heads that control the flow of water for drill steel have not required maintenance to date.

"The Le Roi air legs are doing a good job for us in the tunnel," the superintendent added. "They have performed continuously with a minimum of downtime, helping us to keep up with our schedule."

Types Available

Le Roi H10AL air legs are available in single or telescopic types, with 3, 4, 5, or 6 ft. feeds. Your operators will find them easy to handle in roof-bolting, stoping, drifting, or sinking operations. See them at your Le Roi distributor, or write the Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wisconsin.

AT-722

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LE ROI Division of Westinghouse Air Brake Co., Milwaukee 1, Wisconsin, manufacturers of Newmatic air tools, Tractair®, portable and stationary air compressors, and heavy-duty industrial engines. Write us for information on any of these products.

Specially-built jumbo rig holds 35 men and 16 air legs. When holes are drilled and charges set, the massive wheel-mounted rig is pulled away.

Le Roi air legs are versatile. View shows them being used for drilling and roof-bolting. Bolt holes are sunk on 4 ft. centers. Men are on top level of rig.

Three-man crews operate two air legs. The Le Roi H10AL air legs are easy to handle, making them ideal for operation in close quarters.

I'M AN OPTIMIST. I'm glad we're in the uranium business. I'm sure that the future will be very bright. By and large the uranium industry is in good position, enjoying a guaranteed market for the next nine years—the most critical years.—Donald H. McLaughlin (center), president, Homestake Mining.

IN UNDER THE WIRE. George T. Bator (left), Fremont Minerals, just received a mill contract with the AEC for a 500 tpd mill to be erected at Riverton, Wyo. AEC policy is that if any new mills are allowed, consideration will be given to fringe areas needing a mill or more capacity.

U_3O_8—Why the AEC Put on the Brakes

WHAT'S THE FUTURE for the uranium producers. Will milling contracts be cut back? How will the expansion slowdown affect exploration? These and many other questions were asked from the floor at the two day meeting held in Denver, Colo., Dec. 16 and 17, 1957. Meeting was sponsored by the Uranium Institute of America and the Chamber of Commerce of the U. S. to provide an informal meeting ground where industry experts, from the ore producer to the economist, could state their views.

No other commodity can compare with uranium's growth. In twelve short years the industry has grown from practically nothing to an industry that will have a Free World production potential of some 40,000 annual tons of yellow cake in 1959. Uranium's dollar value is second only to copper in the U. S.; second only to nickel in Canada; second only to gold in the Free World. In October 1957 the Atomic Energy Commission put on the brakes on domestic expansion—to give the utilization end of the industry a chance to catch up with the amazing record established by the producers.

In 1955 domestic ore production was only about 6,000 tpd. Today there are 725 active mines turning out more than 10,000 tpd. Another year will see 18,500 tpd mined in the U. S. Canadian production will reach 42,000 tpd containing about the same quantity as U. S. output.

Here are some of the questions asked and the opinions expressed. On many points they were in agreement. On some they were not.

Question. Where do we stand on ore reserves?

Answer. Present ore reserves are about 76-million tons, 0.25% U_3O_8, while actual developed reserves are probably approaching 80-million tons. That's only enough for ten years at present milling capacity.—Elton Youngberg, assistant manager, Grand Junction Operations, AEC.

Free World Ore Reserves

Country	Tons	Grade
U.S.	76-million	0.27%
Canada	320-million	0.12%
South Africa	1.1-billion	0.03%
Australia	335,000	0.3%
France	10,000 to 50,000 tons metal	

Q. How much uranium is stockpiled?

A. There is no uranium stockpile, other than weapons, in the U. S. We do not have a stockpile of yellow cake, green salt, hexafluoride or metal. Ore stockpile contains about 1.5-million tons.—John T. Sherman, assistant director for procurement, AEC.

Q. How will the AEC decision to slow down mill expansion affect exploration for domestic uranium since we only have enough for ten years?

A. There won't be a rig in operation within a year.—Ambrosia Lakes operator.

A. Some proper concern may be felt with regard to the effect of the policy on exploration. As Mr. Johnson makes it clear, there is not "too much uranium". Indeed, without further exploration, we shall not be able to maintain our current relative national standing as a producer much longer than one decade. We don't know how well off we are. What other industry, besides gold, has a sure market for the next nine years?

Milling companies will be aggressively seeking new ore. In some areas competition for ore to feed large mills may be a dominant factor, and the possessor of a good orebody tributary to a hungry mill may find himself in a very happy position. This AEC policy by no means rules out exploration. But such ventures must be appraised as a business risk involving market uncertainties. I'm happy to do it. Exploration for new ores must not be neglected.—Dr. Donald H. McLaughlin, president, Homestake Mining Co.

Q. If I have an orebody big enough to justify a mill, plenty of money to build a mill, and can deliver concentrate at less than the $8 a lb now in effect in some mills, can I get a mill contract?

A. Probably not. If new mills are considered, preference will be given to a limited market for areas having no present milling capacity . . . Since the October announcement, contracts

JOHN DEERE CRAWLER-LOADER
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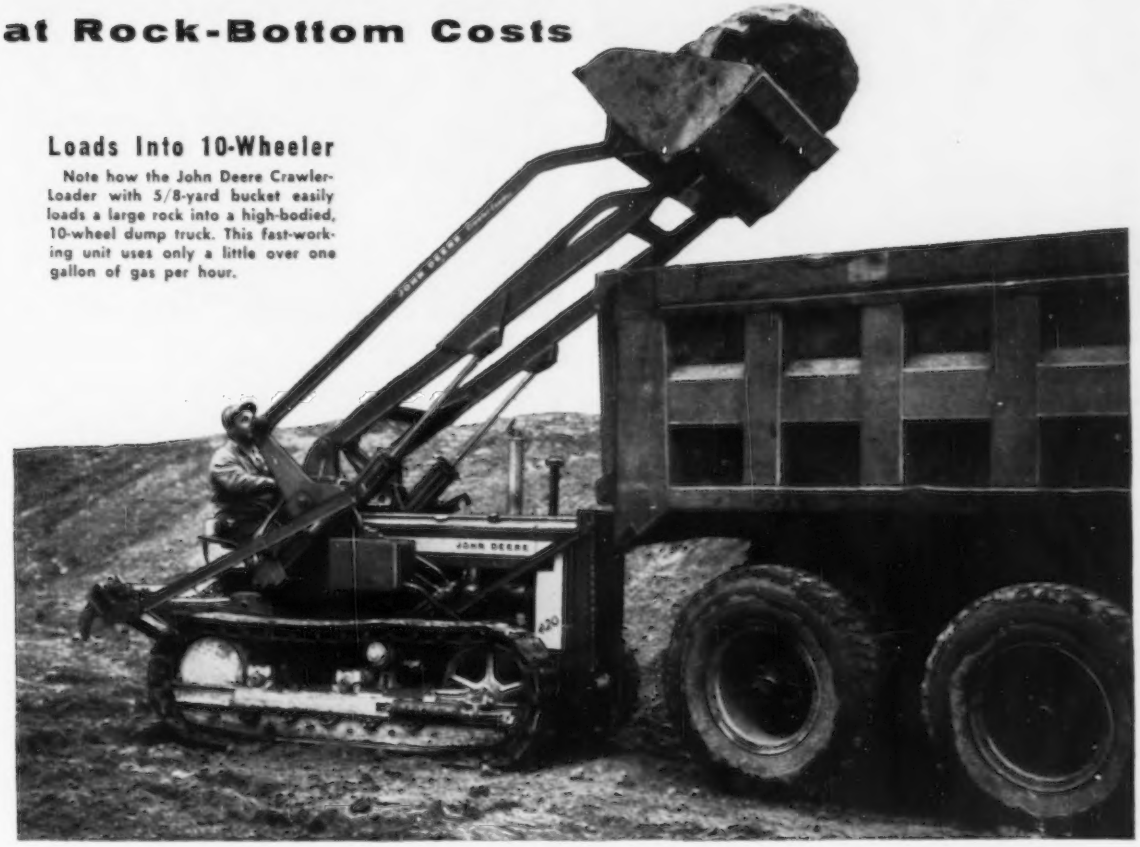

Loads Into 10-Wheeler

Note how the John Deere Crawler-Loader with 5/8-yard bucket easily loads a large rock into a high-bodied, 10-wheel dump truck. This fast-working unit uses only a little over one gallon of gas per hour.

MATCH the work output of larger tractors on many jobs . . . hold down your costs all the way . . . with the John Deere "420" Crawler-Loader—a versatile, high-quality unit that you'll find mighty profitable to own.

Amazing power for its size . . . compact design . . . clutch-brake steering . . . and the fast, handy direction reverser are some of the many features that put the John Deere in a class by itself for speedy, low-cost maneuverability and daily work output.

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WHAT WILL the AEC do for those companies holding Indian land leases that call for a specific amount of drilling and mining within a specific time period? What about the small independent miner?—Patrick J. Hurley (right), president, Uranium Institute; board chairman, United Western Minerals.

NUCLEAR POWER reactors in this country are not yet economic. Present reactor costs are in the neighborhood of 20 to 50c per million Btu, while conventional costs are only 4 to 9c per million Btu.—Dr. Henry H. Hausner (left), vice president and general manager, Penn-Texas Corp.

have been signed to build a 210 tpd mill at Lakeview, Ore. and the 500-tpd Fremont Minerals mill at Riverton, Wyo.—John T. Sherman, AEC.

Q. Where do we stand on milling capacity? And what about our friends?

A. Two years ago we had only 6,000 tpd ore production . . . Today there are some 725 mines in this country producing more than 10,000 tpd total. Another year will see 18,500 tons of about 0.25% ore mined in the U. S. A similar development has taken place in milling. Eighteen months ago we had only three mills with capacities exceeding 500 tpd. When mills now under construction are completed, there will be thirteen with more than 500 tpd capacity. Daily average capacity of a mill today is 700 tons. Two years from now the capacity of a typical mill will average 855 tpd.

In South Africa, we find that all the production comes from large integrated gold mines—29 mines and 17 mills producing about 6,000 tons of U_3O_8 a year as by-product.

Canadian production will come from some 25 mines and 19 mills. Two years from now, Canadian production will rival U. S. (about 42,000 tpd of 0.1% ore). We can foresee a Free World production of some 40,000 tons of U_3O_8 a year about two years from now, a large percentage of which will be bought by the U. S.—John T. Sherman, AEC.

Q. Has U. S. milling capacity been cut back?

A. No. While a limitation is placed on new mill contracts, this hardly amounts to a cutback.—John T. Sherman, AEC.

A. Yes. Domestic mills have been cut back.—S. L. R. McNichols, governor, State of Colorado.

A. No. And the AEC thinks that incentives ought to be sought to keep up exploration. The AEC will welcome industry suggestions.—Jesse Johnson, director, raw materials, AEC at recent Albuquerque session.

Q. Is the recent outcry against the AEC fair? Is the AEC favoring the large captive mines?

A. "In my judgement . . . the outcry . . . is uncalled for. Producers have the unusual security of a guaranteed market until the end of their contracts—and a publicly announced price with certain restrictions until 1966. The fortunate prospector who finds an orebody within economic distance to a mill is still assured of a market for at least a limited tonnage."—Donald H. McLaughlin, Homestake.

A. AEC receipts at the mills in 1957 show that 39% of the feed was custom ore from those small producers who hold only 12% of domestic reserves. Captive mines delivered 48% of the feed and hold 81% of the reserves.—Elton Youngberg, AEC.

A. Small miners have had their mill purchases cut back. And some mills have been ordered to cut their output.—S. L. R. McNichols, governor, Colo.

A. What are you going to do about those people holding Indian land leases? These people have to do a certain amount of drilling and a fixed amount of mining in a limited amount of time or lose their leases and everything they've spent so far. What about the small miner in the fringe areas of the Plateau who will now have no market for the ore?—Patrick J. Hurley, president, Uranium Institute of America and board chairman, United Western Minerals Co.

Q. Can we quit buying foreign production?

A. No. These are firm commitments which are noncancellable. We have not made any foreign commitments for the past several years. Foreign deliveries will hit a maximum in 1959.—John T. Sherman, AEC.

Q. How much do we pay for foreign concentrates?

A. Less than we pay domestic producers . . . Domestic prices averaged $10.50 a lb in yellow cake in fiscal 1957. In fiscal 1958, price will average $9.60. In 1959, price will drop to an average of $9.30. We pay a higher price for domestic yellow cake because we pay for two profits—one for the miner and one for the miller. Foreign prices are generally based on an over-all profit for an integrated mine and mill.—John T. Sherman, AEC.

Q. Someday after 1966, we expect to become a competitive industry. Will we be able to compete with other Free World producers? What does it cost to mine in the U. S. How about the mills? *(Continued on p 136)*

WIRE ROPE AT WORK

This tall skyscraper of the mining country is the headframe of the "A" Shaft, Mather Mine, operated by The Cleveland Cliffs Iron Co., Ishpeming, Mich. Sunk deep into the earth beneath the headframe are the shafts for the two balanced skips and the man-and-materials cage.

Each of the skips has a capacity of 12.5 long tons, and each is rigged with a Bethlehem 1⅛-in. 6x27 flattened-strand rope. A similar rope is used to hoist and lower the cage, while the cage counterweight rigging employs a 6x25 Type W line. These husky wire ropes have proved highly dependable in a system where a fast pace and high production must be maintained. Like all Bethlehem mine and quarry ropes, they have the toughness and stamina that mean lower costs per ton of material moved.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:

MINING • QUARRYING • CONSTRUCTION • EXCAVATING • PETROLEUM • LOGGING • MANUFACTURING

EVEN IF we get reactor power costs down to 10 mills per kwh, there will be only enough new power demand in the Free World to call for 10- to 13,000 tons of uranium per year. This will come about after 1966, or in the late 70's.—Karl M. Mayer (center), director, ACF Industries.

THERE IS no certainty as to when we may expect economic nuclear power in the U.S., though the prospect is good that it will come before the late 60's. Until then, domestic needs will not be significant compared to military.—Charles G. Manly (right), chief, commercial development, AEC.

A. Yes. Provided we maintain our grade and reserve position with respect to the competition. We have a guaranteed price for the next nine years, the most critical years, while we build up a real market.—Donald H. McLaughlin, Homestake.

A. Yes. The domestic producer has several advantages in his favor—higher grades, shallow orebodies that can be mined at low cost, and a guaranteed market until 1966 which will carry part of operating costs. If open competition means a lower than $8 a lb price for yellow cake, then it is the low-grade producer who should go to the wall first. South Africa is the prime low-grade producer. Canadian mills will be in a competitive position with amortized mills—John T. Sherman, AEC.

A. According to Elton Youngberg, AEC, these figures represent the high and low mining costs per ton on the Plateau—exploration, $0.3 to $2; development, $1 to $4.80; depreciation, $0.5 to $2; direct mining, $1.25 to $11; indirect mining, $0.75 to $2. Total mining costs range from $4.80 low in open-pit mining with 5:1 stripping ratio to a high of $20 a ton in the Uravan Mining Belt. These costs do not include royalty or land payment.

A. According to A. H. Ross and Ralph Toerper, these figures represent present range of milling cost in the Free World—

	S. Africa	Canada	U.S.
Operating cost per ton	$1.5	$4 to 7	$7 to 12
Amortization per ton	$0.5	$2 to 5	$3 to 5
Cost per lb yellow cake	$4	$3 to 2.50	$2.50

A. In South Africa a 6,000 tpd mill will cost about $2,000 per annual ton. In Canada, the cost ranges from $4,500 per annual ton in a 1,000 tpd mill to $3,000 on a 6,000 tpd mill. In the U. S., the cost ranges from $6- to 12,000 per annual ton on 200- to 500-tpd mills down to $5- to 6,000 on a 3,000 tpd installation.—A. H. Ross, consultant, A. H. Ross & Associates and Ralph C. Toerper, mill superintendent, Climax Uranium Co.

Q. Will nuclear powered reactors ever become economic? And if so, how much uranium will they use?

A. In the next ten years, American universities will build about 150 exponential reactors, each requiring 5 tons of uranium for a total of about 750 tons. Twenty-five zero power test reactors will also be built, using a total of about 725 tons. Industrial heating reactors may take about 300 tons. Maritime reactors built in the next ten years will use only about 50 tons each of slightly enriched fuel. Most of the fuel for military and test reactors will be furnished by Government as enriched fuel.

By 1968, we will be exporting small power reactors. By 1970 we will expect to have large nuclear power stations installed in high cost areas of the U. S.

The various large power stations now under construction are not expected to be economic initially. As operating experience is gained and reactors are modified we will expect to see economic power in local high cost areas of the U. S. in the next ten years.

We have ten reactors for civilian power projects authorized planned or under construction.—Dr. Stuart McLain nuclear power consultant.

A. There is no certainty as to when we may expect economic competitive nuclear power to arrive in the U. S. though the prospect is good that it will come before the late 60's. Until then the domestic civilian requirements for uranium will not be significant compared to military needs.—Charles G. Manly, chief, commercial development branch, AEC.

A. Right now its only a weapons or military market.—John T. Sherman.

A. McLain made the following estimate on nuclear power station needs in tons of uranium up to 1967:

	Maximum	Minimum
1958	100	100
1959	200	100
1960	1000	900
1961	1100	500
1962	2400	1100
1963	3000	1300
1964	3900	1800
1965	5300	2300
1966	6500	3000
1967	7800	3900
Total	**30,000**	**15,000**

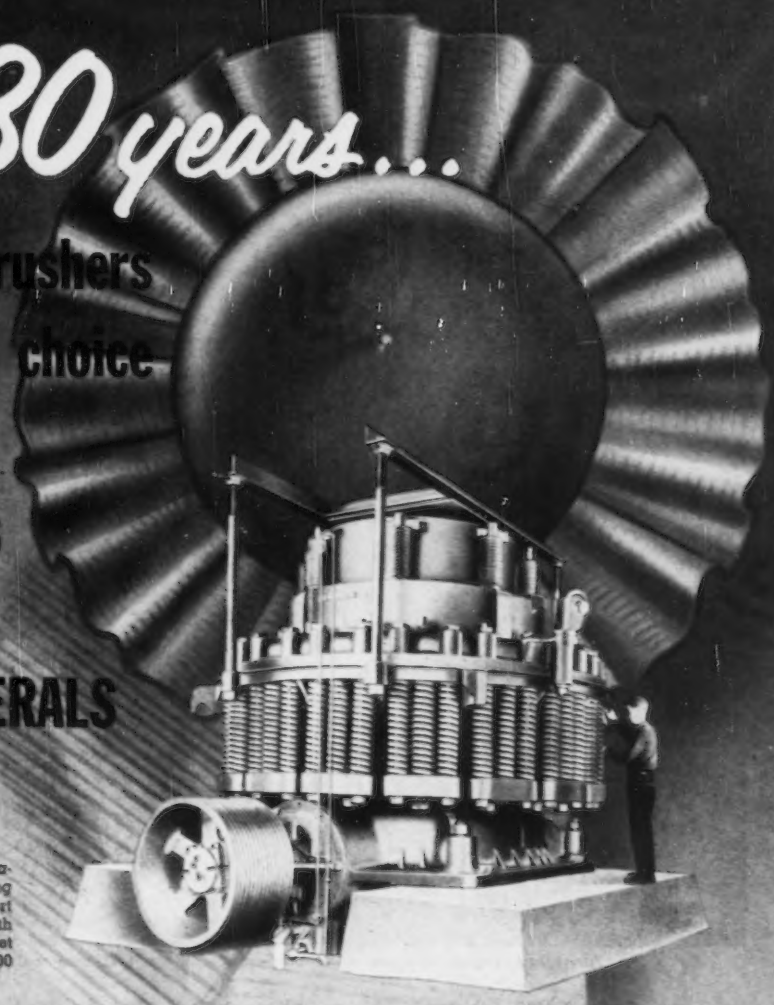
A. Estimates that say we will need from 50,000 to 100,000 tons of uranium a year for nuclear power reactors in 1970 to 1975 must be considered as optimistic.—Donald H. McLaughlin.

A. Even if we get nuclear power

(*Continued on p 139*)

After 30 years...

SYMONS® Cone Crushers are still the first choice of the world's leading producers of ORES and INDUSTRIAL MINERALS



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The introduction of the Symons Cone Crusher some thirty years ago marked the greatest advancement ever made in the field of reduction crushing. The immediate acceptance of this crusher by producers of finely crushed materials has had no parallel with any type of machinery used for similar service.

The dominant position which the Symons Cone Crusher has so consistently maintained in over a quarter-century of service is positive proof of its vastly superior performance in processing big tonnages of finely crushed product at lower cost . . . *and is the reason why Symons Cones are still the first choice of the world's leading producers for volume crushing of metallic and non-metallic ores and industrial minerals.*

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NORDBERG GRINDING MILLS

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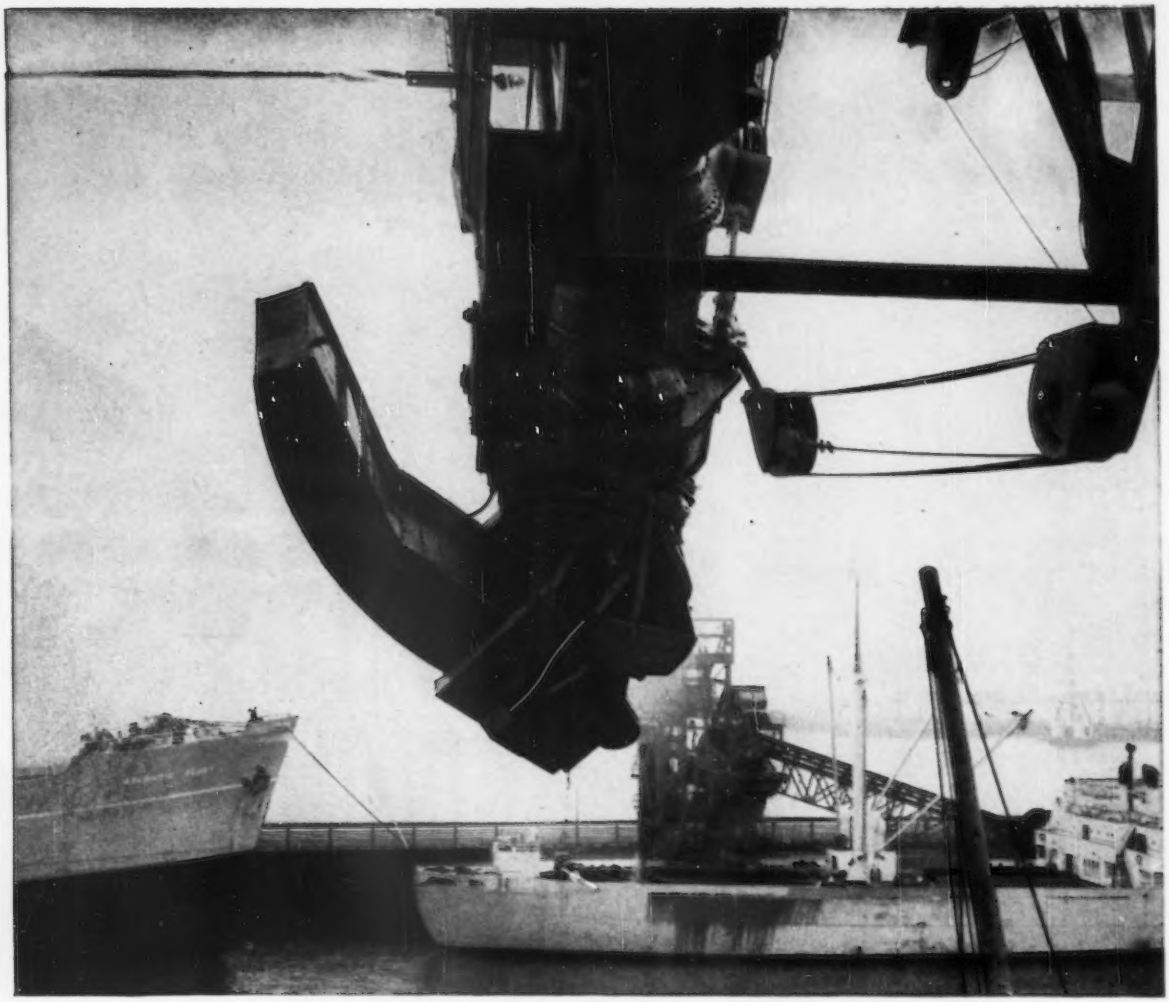

At world's most modern coal docks, Newport News, Va., C&O uses coal trimmers of Lukens "T-1" Steel.

New Coal Loading Machine is tougher and lighter—made with Lukens "T-1" Steel

TRADEMARK

Tough, weight-saving Lukens "T-1" gives this trimmer added mobility.

When the C&O Railway designed this huge new coal trimmer, they chose Lukens "T-1" steel for its combination of high strength and toughness—plus ready workability. Construction required less steel, produced outstanding abrasion resistance.

Now with stepped up efficiency, this mammoth machine easily and economically deposits 2,000 tons of coal an hour deep in the holds of ships—with a minimum of wear and maintenance.

Whether you handle coal, stone, gravel or metal ores, Lukens "T-1" steel used in areas hardest hit by punishing abrasive impact will save you money, too. It has tripled the life of rock driers. The 321 minimum Brinell quality has been known to outlast previous metals by 18 to 1 in quarry wear plates. Chutes, hoppers, and mine cars are other typical applications.

And Lukens "T-1" steel retains its remarkable toughness at temperatures well below zero. Send for our informative illustrated booklet, "Lukens 'T-1' Steel." Write Manager, Marketing Service, Room 959, Lukens Steel Company, Coatesville, Pennsylvania.

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reactor costs down to 10 mills per kwh there will be only enough new power installations in the Free World to call for from 10- to 13,000 tons of uranium a year. This will probably come after 1966 or in the 70's. Most of this business will be in Europe since at even 10 mills this is too high for most of the U. S. power regions.

My estimate is conservative, based on purely economic reasons which would call for installing new additional electric generating capacity—not on any political considerations. If we can't get a reactor under 15 mills per kwh then the uranium needs would be less than 3000 tons per year.—Karl M. Mayer, director economic research, American Car & Foundry Industries.

A. In terms of concentrate the initial fuel inventory required for each 1-million kilowatts of electricity nuclear power capacity is estimated roughly at 1500 tons which includes 500 tons for the reactor pipeline. Annual burn up and loss is estimated at about 300 tons. This estimate is based on using a thermal reactor with enriched 235 fuel. While the breeder reactor may come into being in the next few years I believe that the thermal reactor will be most important for some time to come.—Charles G. Manly AEC.

A. The conceivable market for cobalt 60 in process industry control may amount to as much as 2-billion curies in the next 15 years. If such a cobalt 60 market should develop we will use 10- to 20,000 tons of uranium and require a further 1- to 2000 tons annually to replenish the fuel supply. However, considering what is economic at the present we can only use about 8 tons.—Dr. Donald C. Brunton, Curtiss-Wright of Canada Ltd.

A. Uranium-fueled power generator costs will come down crossing conventional fossil fuel costs in 1965 or after.—Henry H. Hauser vice-president Penn-Texas Corp.

A. In Europe they build conventional steam power plants for what it will cost to handle the fuel inventory of the Fermi Breeder Reactor at Laguna Beach, Mich. — Karl M. Mayer.

A. I believe that if we were allowed to assemble our most experienced scientists from the atomic field into one group that we could design nuclear power plants that would be nearly economic today.—Stuart McLain.

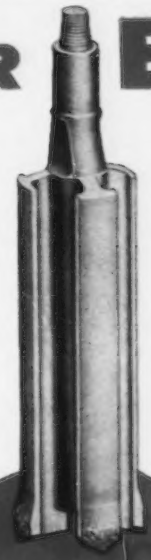
A. Why are nuclear power costs so high? Potential and unknown hazards call for unusually high standards of safety, driving costs up. We're exploring a new field and we don't really know enough about it yet. Many reactor material specifications set by the Government are unrealistic. We ought to quit trying to make the most perfect piece of equipment and make the most economic—that's what we're after—economy, not perfection.

Also we're a long way from a standard nuclear fuel element that could be mass produced. We have 20 to 30 alloys under development at this time and the cost will be necessarily high until we settle down on the one all-around best fuel element—Henry H. Hauser, Penn-Texas Corp.

A. Complicated cost of fuel element construction may make the Fermi Breeder Reactor uneconomic for a long time to come. Fuel will be reprocessed as follows: fabricated into elements, used with a little recycled each week on a total 15 week recycle period, cooled, dismantled, chemically refined or smelted, refined and refabricated into an element. This applies to both the core and the breeder blanket fuel.—John H. Hanna, Atomic Power Development Association.

A. Mr. Hauser reports that the National Industrial Conference Board made the following cost estimate on a 100 to 150 megawatts nuclear power plant for the period 1960 to 1970:

FABRICATED STAR BITS



The Fabricated Star Bit shown here has been designed especially for big hole drilling in hard formations. Far more efficient than the old style spudding bit and the big hole paddle-type bit, these Star Bits are custom-engineered to suit the particular hole size and the capacity of the drilling machine used.

Spang Fabricated Star Bits save labor and money. They can be quickly dressed to gauge, and speedily ready for drilling, by hard surfacing the cutting edge.

Here is a Fabricated Star Bit that has been successfully proven on numerous large hole projects. It is available in a wide range of diameters, and weights . . . the lengths in which they can be furnished are directly related to their overall weight.

Complete details and literature on request.

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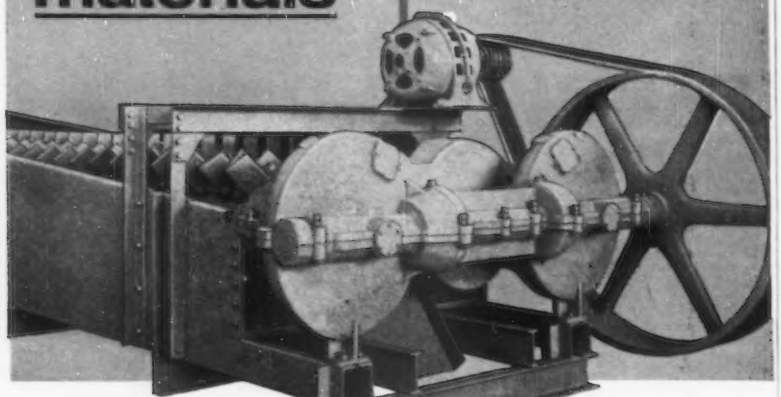
High Capacities of clean materials

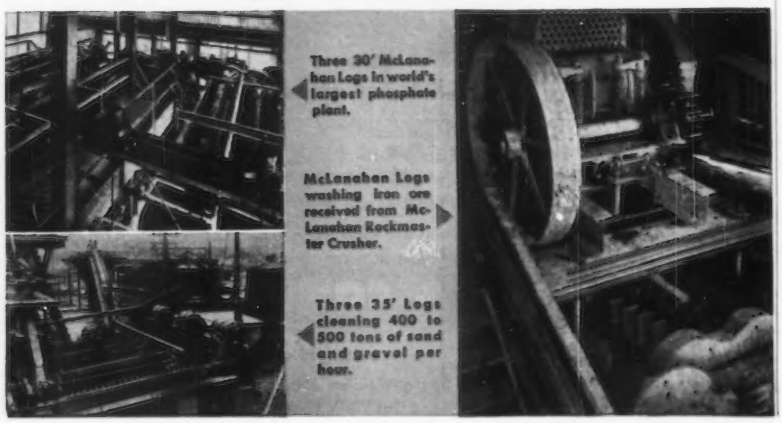
Developed from the world's first all-steel log washers built by McLanahan & Stone in 1894, these machines produce high tonnages of exceptionally clean materials—removing tough clay, soft rock and refuse with unequalled speed and economy. Available in Heavy-Duty and Mudmaster styles. *Write for Bulletins WLO-1155 and MM-755.*



McLANAHAN SINCE 1835

LOG WASHERS

McLANAHAN & STONE CORPORATION
255 Wall Street, Hollidaysburg, Pennsylvania


Three 30' McLanahan Logs in world's largest phosphate plant.
McLanahan Logs washing iron ore received from McLanahan Rockmaster Crusher.
Three 35' Logs cleaning 400 to 500 tons of sand and gravel per hour.

	Cost in mills per kwh
Plant	6
Operation and maintenance	1
Fuel	
uranium used	1
fabrication	1.5
reprocessing	2
inventory	0.5
Total	12.0

Total cost does not allow for any plutonium credit (2 mills).

Q. What are the chances for a maritime nuclear-powered fleet?

A. Excellent. Nuclear-powered ships will not need to carry huge fuel oil loads. They can use the space saved for cargo, raising the cargo to fuel consumed ratio. Surprisingly enough a 15 to 20 mill nuclear power plant will be competitive in certain types of steam ships. Our smaller ships are not very economic—only 25% efficient whereas we hope to get 35% efficiency from a nuclear plant. We will have 5 to 10 nuclear-powered steamships in the next ten years.—Richard P. Godin, AEC.

Q. Is the fusion reaction a danger to nuclear fission in the reactor power field?

A. No. Fusion will be solved, but by the time it gets here, nuclear fission power will be well established in our power plants—a standard part of our power system. I think that it is rather absurd for us in the uranium mining industry—or particularly the investors in the industry—to get the jitters every time the newspapers announce that a stray neutron or two escaped through the walls of a fusion research electromagnetic bottle. Wonderful and impressive as these achievements are, they do not in my judgment constitute a threat to the market for our uranium.—Donald H. McLaughlin.

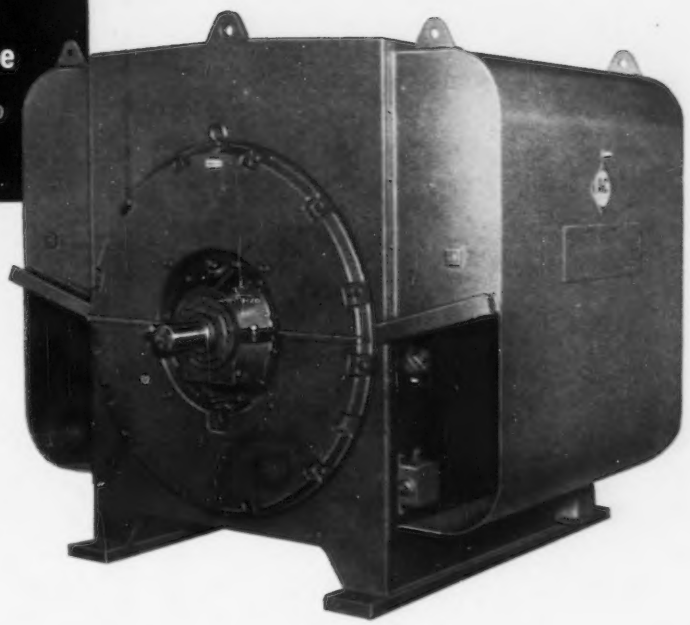
A. The fusion process will come. It will almost certainly be more expensive than fission. The object of economic fission power is a 6 mills per kwh cost with the fuel cost of one mill. Now if the fission fuel were free, we could only reduce our power cost by 15%. Fusion may provide us with a cheap fuel, but the capital costs will be higher than for our present fission costs, because the thermonuclear or fusion process is even more difficult to handle.—Donald C. Brunton, Curtiss-Wright.

A. It seems to me that fusion will have the problem of competing not only with coal, oil and gas as we (uranium) must now, but fusion will

(*Continued on p 143*)

Eliminate costly enclosures with Allis-Chalmers weather-protected MOTORS

Modern features
cut operating, maintenance expense . . . give MORE dependability



Here's a newly designed line of Allis-Chalmers weather-protected motors with the ability to "take" outdoor conditions. This means no expensive protective enclosures are needed . . . a big saving in plant or installation building costs.

Designed to meet defined NEMA requirements, these motors incorporate many important features which assure dependable outdoor operation:

- **Ventilating System** — Low velocity intake, vertical lift, change of direction and high velocity discharge of ventilating air keep rain, snow, sleet, dust and dirt out of vital parts.
- **Removable Air Ducts** — To facilitate inspection and maintenance of interior air passages, air intake ducts are designed for quick removal.
- **Stator Assembly** — Removable as a unit, it simplifies maintenance and minimizes downtime.
- **Split Sleeve Bearings** — Capsulized design permits access to motor interior without disturbing the bearings or their enclosures. Positive vapor seal is used on high-speed motors. Antifriction bearings are available for slow speed motors.
- **Proven Insulation** — Famous Allis-Chalmers insulation systems (Class A and B) are available. And, for extreme temperatures, or where high resistancé to abrasion and moisture is required, Allis-Chalmers can provide the revolutionary *Silco-Flex* system.

Silco-Flex is an Allis-Chalmers trademark.

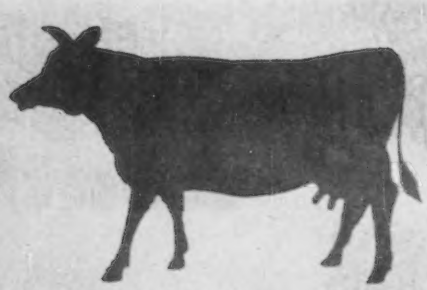
THIS DESIGN available in ratings from 250 to 900 hp. Other designs in larger horsepower ratings are also available. Contact your A-C sales office or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin. Ask for Bulletins 51B8606A and 05B7894.

A-5292

ALLIS-CHALMERS

NATIONAL ELECTRICAL WEEK
FEB. 9-15, 1958

take the *SPECULATION* out of specs with... MARCY



SPECIFICATIONS: 4 legs, tail, ears, eyes, nose, covered with hide, walks. Feed: grass. Product: milk.

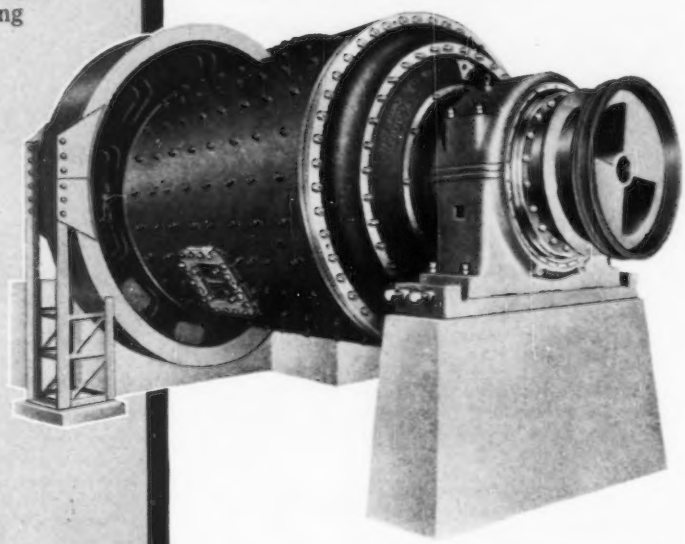
SPECIFICATIONS: 4 legs, tail, ears, eyes, nose, covered with hide, walks. Feed: grass. Product: milk.

The specifications read the same. Which did you want? Goat's milk or cow's milk? Did you expect the production capacity of a goat or a cow?

A goat or a cow... perhaps a ridiculous analogy. However, grinding mill specifications may *read* the same, too!

That's why it's so important to look beyond the specifications. When you do you will find the reasons for Marcy's dependable performance... more than 50 years devoted exclusively to grinding has resulted in an accumulation of grinding "know-how" unique in the industry... specialists in *grinding* research, design and engineering; specialists in selection and use of materials for manufacturing *grinding mills*; manufacturing facilities developed specially for the best production of *grinding mills*; metallurgical engineers specially trained in *grinding*. And, a background of *proved* performance ...Marcy Mills in 29 different diameter sizes, from 12″ to 12′ 6″ are operating and proved in the field.

These are the factors behind *Marcy* specifications which take the speculation out of specs.



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MARCY

have to compete against the by then vastly improved fission uranium reactors. I see no reason to fear the development of controlled thermonuclear energy.—Charles G. Manley, AEC.

Q. In following through with Mr. Johnson's request, do you have any recommendations to the commission?

A. I strongly urge that the AEC continue its policy of establishing ore buying stations in areas where discoveries have been made—giving them a market. Who's to say that there are not other Ambrosia Lakes to be found? Or that a Shinkolobwe won't be found, particularly in the Canadian Shield? Let's keep looking and hoping that we'll find it rather than someone else.—Donald H. McLaughlin.

A. Give us less secrecy on nonsecret or classified information about Government policy. We should be ready for the future . . . our Government . . . the AEC . . . must give us a break on these things. What commitments have you made abroad? How much will you buy from us? What about the Indian leases? Will you help the small miners? Give us the facts so we can make an intelligent business-like decision.—Patrick J. Hurley.

A. Provide milling facilities for those areas lacking mills or needing expansion. Cut foreign purchases gradually each year until a 60% domestic and 40% foreign ratio arrives in 1960. Build small mills in fringe areas. Re-allocate ore buying to give more market to non-captive mines. Re-affirm the original guarantees made to mines and mills. Require the mills to take the 0.1 and 0.2% ores listed in Circular 5.—S. L. R. McNichols, Governor, Colo.

Uranium, Potash Boost New Mexico State Output

NEW MEXICO'S mineral output—excluding gas and oil—hit a record $164,297,494 for the fiscal year ending June 30, 1957, according to State Mines Inspector John A. Garcia's annual report.

The state's production totaled $155 million in 1956 fiscal year. Highlights from Garcia's report:

Record output was reached despite sharp slumps in copper ($48,642,380 in 1957 compared to $61,567,627 in 1956) and manganese ($1,616,249 in 1957 as against $3,677,464 the previous year).

Uranium production—in which New Mexico now leads the nation—showed a jump of more than $13-million. Production in fiscal 1957 totaled $28,364,383 compared to $15,349,376 the previous year New Mexico also leads the nation in potash production which soared to $60,794,998 in 1957 as against $55,659,278 in fiscal 1956.

Kermac Nuclear Fuels Corp. signed a contract with AEC for erection of a 3,300-ton mill and Phillips Petroleum Co. recently announced plans for a $9.5-million mill—both to be constructed in the Ambrosia Lake.

Other large firms developing new mines in the Grants area are: Vanadium Corp. of America; Westvaco Mineral Development; Calumet & Hecla and Dalco Uranium Co. Eight new shafts are being sunk and additional shafts will be started before the end of the calendar year 1957. Three new shafts recently completed and now on limited production are Holly Minerals, Kermac Nuclear No. 10 and St. Anthony Uranium.

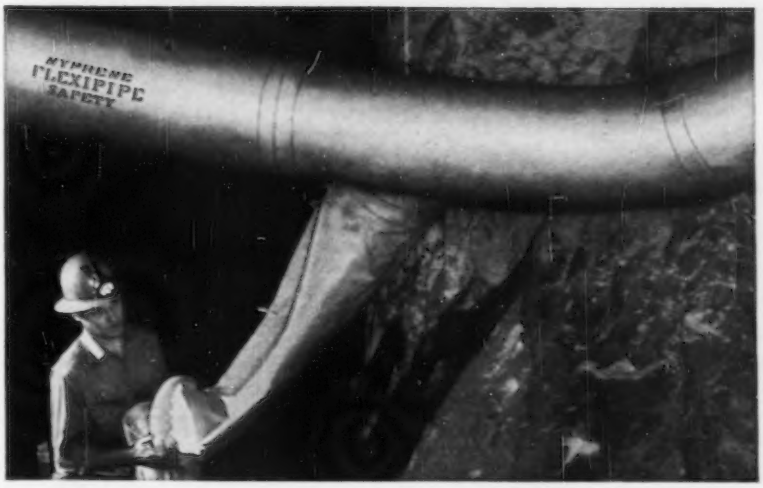
The uranium industry now employs 1,650 in actual production; an estimated 1,000 in mill construction and about 800 on exploration.

Potash shipments totaled 12,464,619 crude tons, up four per cent.

The six producing companies, all operating mines and refineries in the Carlsbad area, expended $11-million for expansion and improvements during the year.

The National Potash Co. began production in February, 1957 and a seventh company—Farm Chemical Corp.—is now sinking its first shaft.

THE BIGGEST NEWS IN MINE VENTILATION TUBING . . .



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- Featherweight—fast, easy handling saves labor costs.
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- Stores compactly—requires small warehouse space.
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Bemis also manufactures durable, economical Jute-grade FLEXIPIPE. Both types (Jute-grade and Safety Yellow) are available with Bemis Rope Seam Suspension at no extra cost.

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The new, boltless, speed coupling, *Style 78.* Hinged into one assembly for fast piping hook-up or disassembly. Hand locks for savings in time and money. Ideal for portable lines. Sizes 1" to 8".

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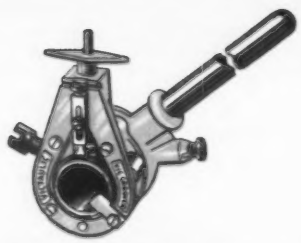
Elbows, Tees, Reducers, Laterals, *a complete line*—fit all Victaulic Couplings. Easily installed — top efficiency. Sizes ¾" to 12".



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VICTAULIC COMPANY OF AMERICA
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Calera Mining Installs "Electro-Winning" Setup

Calera Mining Co., subsidiary of Howe Sound Co., has completed installation of a system of "electro-winning" at its cobalt plant at Garfield, Utah. Introduction of a "de-nickeling" process and other changes in the process equipment will cost a total of $750,000.

The de-nickeling unit will remove the 2% nickel now contained in the Calera product. This will assure production by 1959 of cobalt chips of 99.8% purity, according to J.S. Mitchell, plant manager. Mitchell believes that utilization of the system, (basically a closed electrolysis) will add 4- or 5% to the production of the plant, or around 9,500 tpd of metal.

In the system of electro-winning of the cobalt metal, former circuits for digestion, of concentrates from the firm's mine and mill at Cobalt, Ida. is unchanged. Filtration and solution purification also is the same.

Under "electro-winning" the process is continuous. The electrolyte in this case is the pregnant liquor or purified solution (cobalt sulphate).

This solution containing cobalt metal is circulated through 28 electrolytic tanks in a new tank house. Total voltage on the tank house is only 150 v or 4½ v per tank.

A non-soluble, lead anode is employed to discharge the current in the cobalt sulphate bath. A stainless steel sheet, treated with phosphoric acid to improve later stripping, serves as the cathode.

It takes seven days for the starter sheet to build up the required deposition of metal. The entire process is automated by instrumentation installed by Leeds & Northrup Co.

Stripping is by hand tools at present. The firm is scheduling use of power hammers, etc. in this process cathodes are re-used. Currently, the metal is again transformed to granular form for sale to the Government. With addition of the de-nickeling unit, however, the pure cobalt will be treated with chromic acid to remove slight sulphur staining, then cast into chips for shipment in barrels.

The electrolyte is strengthened and cobalt additions made to the continuous circuit following regular discharge from the tanks by the addition of cobalt hydrates.

This serves to hike the alkalinity factor of the solution returning to the tanks. (Cobalt hydrates are converted to cobalt sulphates in the electrolysis process in the tank house.)

The cobalt hydrates are supplied by the treatment of the purified solutions coming from digestion-filtration section of the plant with calcium hydrates.

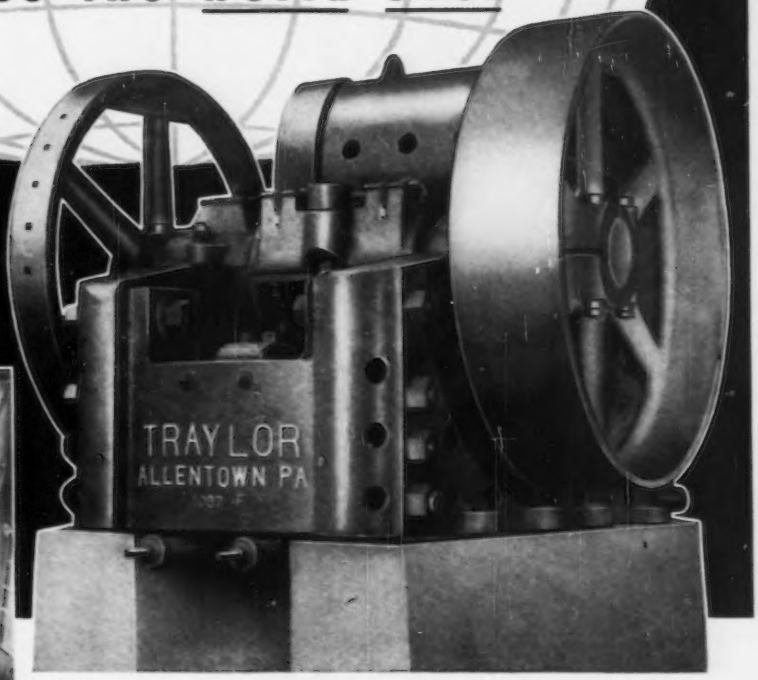
This solution is then filtered to a cake.

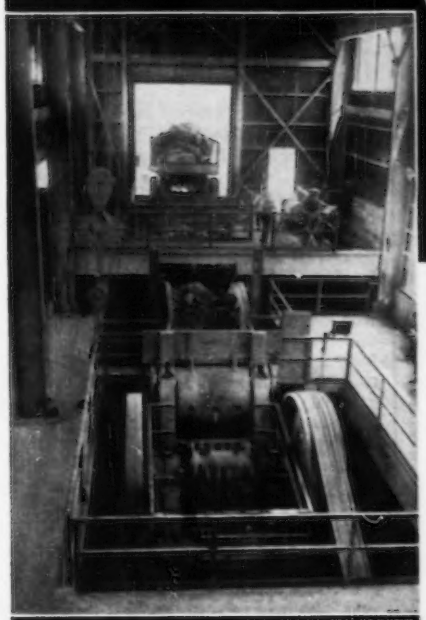
The cobalt hydrate cake is then added to the tank-house solution. The renewed solutions go into a thickener. From the thickener (overflow) they return to the tanks.

When leaving the tank house, solutions contain some 35 grams per liter of

Traylor-MADE
for use the world over

TYPE S JAW CRUSHER





48" x 60" Type S Jaw Crusher in Portland Cement Plant.

Traylor Type S Jaw Crusher is designed to stand up under the most severe crushing duty. Some features include:

- A sectional cast steel frame of unusual strength.
- A strong, forged steel rod type pitman.
- A three-bearing toggle system that reduces frictional loss and economizes on power.
- A safety device that reduces the possibility of breaking any part of the crusher.
- Smooth-faced Traylor patented curved jaw plates that practically eliminate packing.
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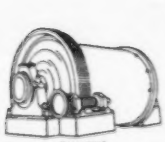
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Jaw Crushers

Secondary Gyratory Crushers

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Whether it be a "one family rig," or worldwide company, it's all the same to the Christensen engineeer whose only concern is "less cost per foot" for the operator. No matter where or how you drill there is a qualified Christensen engineer available for on the job consultation and to supply the diamond bits and barrels matched to your formation, designed and proved to give the best results under any conditions. Call Christensen today and operate at "less cost per foot."

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CHRISTENSEN DIAMOND PRODUCTS

1937 SOUTH 2ND WEST • SALT LAKE CITY, UTAH

Calera *(Continued)*

cobalt values. Thus some 10 grams per liter are added continuously.

The production and addition of cobalt hydrates is controlled automatically by pH metering, with instrumentation by Leeds & Northrup.

Filtration, of colbalt hydrates and calcium sulphates, is accomplished with several Eimco filters of various size and design.

Electro-winning is distinguished from electrolytic refining in that with latter process the fire-refined copper anode is soluble in the electrolyte (copper sulphate) with the build up of copper ions on the pure copper cathode—or starter sheet.

There is virtually no slime deposited in the electro-winning of cobalt at the Calera plant.

The process was perfected for Calera by Dr. Martin Fassell, director of Howe Sound's research laboratories at Salt Lake City. It is basically akin to the Rhodesian (South African) process of cobalt reduction "with some refinements," says Mr. Mitchell.

Honduras Resources Draw Outside Interest

ROBERT E. LAWRENCE, Inspector General of Mines, Honduras, told *E&MJ* in an interview in December that he was departing for France to enlist French Government support in a technical aid program for Honduras. He also said that German manufacturers were setting up four-year scholarships for Latin American engineering students to acquaint them with the European advances in technology and modern mining and mineral processing equipment. Mr. Lawrence said that scholarships offered to foreign students by the U.S. International Cooperation Administration were limited to six months or a year, and as such were too short in term to do much good. U.S. Government budget restrictions makes this necessary. Lawrence suggested that Congressional appropriations for technical aid scholarships might be extended to cover four-year terms, with stipulation that the entire appropriation be made in a single year, and held in trust by the University designated in the scholarship award.

Imposition of a U.S. lead-zinc tariff will create real hardship for Central American producers, Lawrence said. He reported that the possibility of a tariff imposition was prompting several international mining groups to study the possibility of building a lead-zinc smelter on the north coast of Honduras.

Lawrence said that during the past year many European and U.S. mining firms have been looking for mineral properties in Honduras. It was his opinion that scouts for these companies had spent too much time inspecting known areas, and not enough time exploring the potential new mineral areas in Honduras. The Honduras Department of Natural Resources encourages the de-

OKOCORD CABLES
take the bending, abrasion and abuse of stripping operations

Power cables on stripping shovels are subjected to constant scraping, twisting and dragging over rough ground and coal-bearing strata. Only the toughest can take it. That's why you'll see so many Okocord Shovel Cables on so many stripping jobs. For Okocord Cables have proved their worth time and time again in all kinds of weather and service.

Their rugged Okoprene sheath is known for its outstanding toughness and abrasion resistance . . . as well as its ability to withstand flame, chemicals and moisture.

Keystone butyl insulation resists heat that builds up when the cable is coiled. It also provides maximum protection against ozone.

Conductor shielding—consisting of a full covering of coated copper wire braid—not only protects the men handling the cable, but also reduces voltage stresses and prevents the formation within the cable of corona and the resulting ozone which attacks rubber insulation.

Non-wicking, neoprene fillers give a firm, round core and protect the cable against damage from sharp bends and run-overs by equipment.

And the engineering and workmanship that go into every Okocord Cable are known for their uniformly high quality and dependability. Okocord Cables exceed N.E.M.A. and IPCEA Standards for portable cables.

Get the complete story from your Okonite salesman on why it'll pay you to always use Okocord Cables on your stripping shovels. The Okonite Co., Passaic, N. J.

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Got A Tough Digging Job?

● SOFT GROUND

● DEEP WATER

● NARROW SPACE

● STEEP HILLS

Use A Sauerman DragScraper

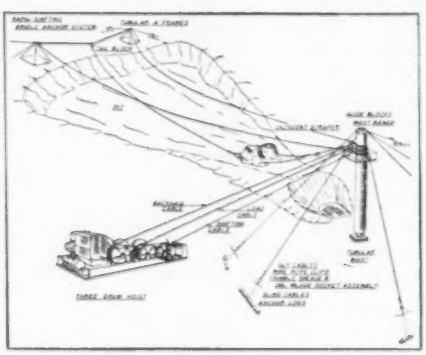
● **SOFT GROUND**—Sauerman DragScrapers work on surfaces where wheeled equipment cannot go and where mats are required to operate a dragline. The DragScraper digs and hauls its load quickly at ground level to hopper or pile. It carries a payload of two to three times its weight. You are not paying the power costs of a heavy machine with a handling capacity that is just a small portion of its weight.

● **NARROW SPACE**—A DragScraper can be operated through an opening no larger than the bucket's width. They are used successfully in culverts, sewers, tunnels, under bridges and buildings. Locations with limited space and head room . . . unworkable with other equipment . . . are handled efficiently and economically with a DragScraper.

● **DEEP WATER**—A Sauerman DragScraper will dig as much as 100 ft. below water... this is far below the safe depth that a dragline bucket can go without the danger of undermining and overturning the machine. Use a DragScraper for trenching, digging channels, lakes or for beach construction.

● **STEEP HILLS**—These are routine for a DragScraper. Material can be taken from anywhere on the bank. Digging from the top of the slope eliminates cave-ins—and the DragScraper gives an extra bonus by pushing additional material in front of the bucket on its way down the slope.

The Sauerman DragScraper operator and hoist is always located away from any hazardous area. It is designed for years of safe, continuous duty, handling bucket sizes up to 15-cu. yds. over spans to 1000 ft. or more.



THE SAUERMAN METHOD—*showing a basic DragScraper installation. Variations of this method are Sauerman engineered to handle the toughest digging jobs at the lowest cost per cu. yd.*

When you have a "tough-to-handle" job consult Sauerman engineers about Sauerman equipment and the Sauerman Method. Request Catalog A, also the Sauerman News and field reports.

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Crescent Scrapers • Slackline and Tautline Cableways • Durolite Blocks

Honduras (*Continued*)

velopment of mineral resources, and with the assistance of Mr. Lawrence has drawn up a new mining code, which when adopted will offer attractive terms to venture capital. Several proposals by European mining companies to mine Honduran mineral deposits are under consideration by the government.

Salt Lake Tungsten Closes Its Refinery

SALT LAKE TUNGSTEN Co's refinery will close Jan. 15, said Blair T. Burwell, Jr., general manager at Salt Lake City.

His firm is a joint affiliate of Minerals Engineering Co. and Sylvania Electric Products Co., electronics producer.

Following closure, the refinery will be placed on stand-by basis.

However, there is some question of what re-activation costs would come to years hence.

The firm was scheduled to launch a program of production of high quality, para-tungstate in 1958, provided the interim Government purchasing program providing transition to free market status of domestic producers was forthcoming. The last session of Congress failed to approve supplemental appropriations for this plan, however.

Consequently, Minerals Engineering on Labor Day, 1957, closed its big new Calvert Creek mine and mill at Glen, Mont. and stopped purchase of custom tungsten ores at Salt Lake City.

The refinery in last months has been running a "clean-up" of concentrates available from past purchases.

Some 30 employes will be affected by the closure in 1958.

The plant had, since its start up, employed a normal labor force of 50.

Its goal was the utilization of tungsten ores found in a wide area of the Intermountain States, discovery and initial development of which was occasioned by desperate need for tungsten in World War II.

Prior to this, it was the general opinion that there was not sufficient tungsten in the region to warrant prospecting for the metal.

The experience of the Salt Lake operation, however abortive, finally proves that theory incorrect, miners say.

Foreign Investors Seek Brazil Iron Ore Sites

FOREIGN DEVELOPMENT of the vast iron ore resources in Brazil's Minas Gerais, Goias, and Matto Grosso states, is finally getting into high-gear.

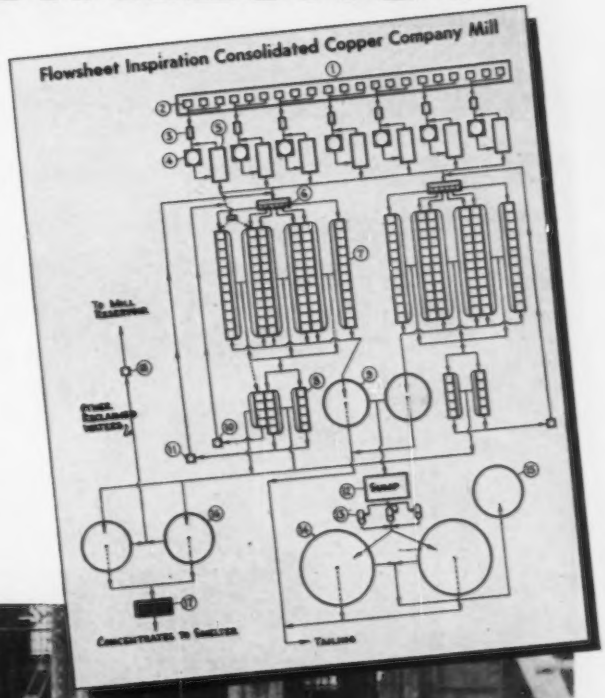
Activities thus far had been limited to the speculative and drawing board stages (ore transport bids from Germany, Japan, the United States, and Poland; Japanese plans for development of present facilities and to expand in Rio Doce Valley, etc.). Now, however, following President Kubitschek's call for

INSPIRED METALLURGY*

extends INSPIRATION'S *reserves*

A new lease on life has been achieved by Inspiration Consolidated Copper Company, Inspiration, Arizona, through the complete rehabilitation of facilities idle for over a quarter of a century. Below are some of the highlights of the operation. For complete details, write for Wemco Bulletin F5-B30. A-1

- **Dual Process, using acid leach for oxide fractions and flotation for sulphides.**
- **Increase in capacity, originally 10,000 tons, now 15,000 tons of ore per day.**
- **Simple flow sheet, with unique test circuit providing for a 2,500 t.p.d. pilot plant within the commercial circuit.**
- **Wemco-Fagergren flotation machines used throughout; 144 cells for roughing, 24 for cleaning.**



Wemco Fagergrens are controlled from a console, with a separate indicator for each unit.

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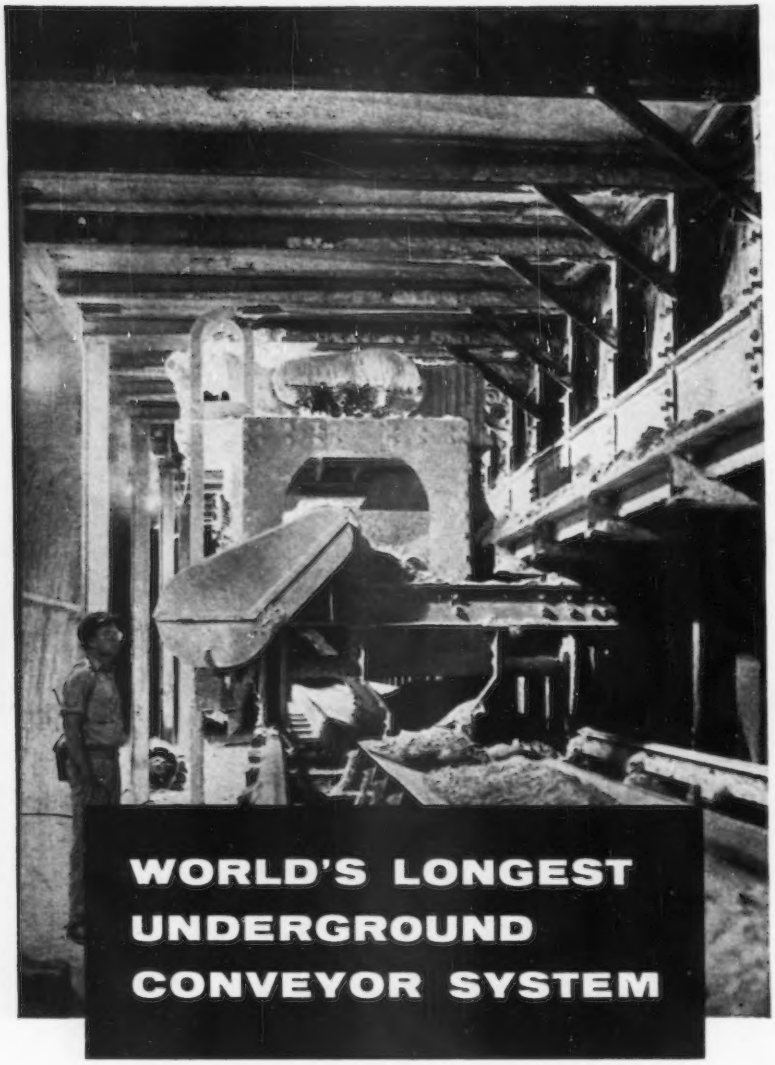


This rotary plow feeder is part of a 45-unit, 7½ mile Hewitt-Robins belt conveyor system located 1000 feet underground in Carlsbad, N. M. The system is designed to carry up to 550 tons of potash ore per hour from mining areas to a storage pit. Here the H-R rotary plow feeder scoops ore onto another conveyor for its trip to the refinery skip hoist.

As in hundreds of other industrial installations, this Hewitt-Robins belt conveyor system effects a material saving in handling costs. To find out how H-R products and services can help you, consult your classified telephone directory for the nearest H-R representative, or contact Hewitt-Robins, Stamford, Connecticut.

HR HEWITT-ROBINS

CONVEYOR BELTING AND IDLERS...POWER TRANSMISSION DRIVES
INDUSTRIAL HOSE...VIBRATING CONVEYORS, SCREENS & SHAKEOUTS

Investors *(Continued)*

a doubling of Brazil's steel production by 1961 and that steel makers (both government and private) would get top priority attention and governmental assistance, foreign firms have come forth with definite plans for Brazilian ore extraction.

One of the largest, a joint Brazil-Japan commission studying the possibility of putting a 500,000-ton mill in the heart of Minas Gerais, got approval plus a green light on various financing schemes. National Steel Co. and the Vale do Rio Doce Iron Co. (both from Brazil) are coming into the deal via the National Development Bank which is taking charge of the Brazilian financing and over-all guidance of operation's capitalization ($57-million—initial capital, 40% coming from Japanese group which includes Isikawajima, Iwata, Juji, Kobe Seiko and others).

USGS Re-Districts

PART OF THE TERRITORY previously served by the U.S. Geological Survey's northwest regional office in Casper, Wyo., has been transferred to the southwestern regional office.

The Interior Department has announced that boundaires of the geological survey's southwestern region, oil and gas leasing branch, will be expanded to include all of San Juan county in Utah and all lands within the west ranges of the New Mexico principal meridian embracing all of the Colorado counties of Montezuma, La Plata, Dolores, San Juan, Hinsdale, San Miguel, Ouray and Montrose and parts of Mesa, Delta, Gunnison, Sagauche, Mineral and Archeulta counties.

The southwest regional office is in Roswell, N.M.

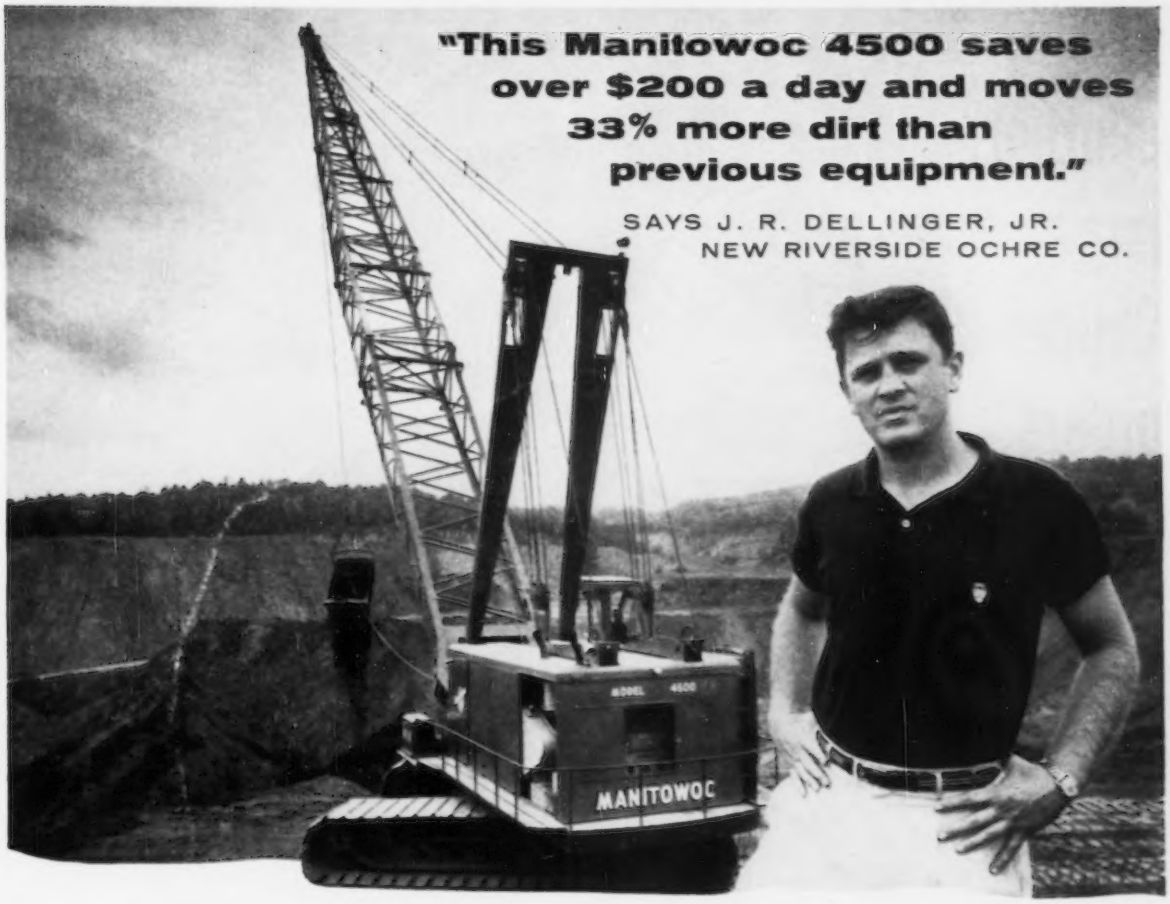
California Announces Safety Law Hearings

MINING MEN will get a chance to speak out on a proposed set of mine safety orders at hearings slated for Feb. 19 in San Francisco and March 5 in Los Angeles.

A. C. Blackman, chief of the state industrial relations department's division of industrial safety, invited those interested to attend in person or submit written comments to the division's office at 965 Mission St, San Francisco.

The existing regulations, adopted in 1938, were completely rewritten by an industry committee headed by Emory Smith of the division of industrial safety. Represented on the committee were mining firm management, labor unions, governmental agencies, and insurance companies.

Approval of the industrial safety board will have to be obtained to put the new orders into effect. They would become effective 30 days after they are filed with the secretary of state's office.


"This Manitowoc 4500 saves over $200 a day and moves 33% more dirt than previous equipment."
SAYS J. R. DELLINGER, JR.
NEW RIVERSIDE OCHRE CO.
MANITOWOC

The New Riverside Ochre Company, Cartersville, Ga., increased the output of barite ore by one-third after putting a Manitowoc 4500 dragline to work in the company's open pit mine. "In addition, the 4500 easily saves us $200 a day in labor and operating costs," says Mr. James R. Dellinger, Jr., partner in the operation.

2400 Yds. per shift

The overburden runs between 30' and 65' deep. Equipped with a 140' boom and 4½-yd. bucket, the 4500 first strips the overburden then excavates and stockpiles the ore for weathering. A week later the ore is shovel-loaded into trucks for washing and breaking. Present output is running about 2400 yards per 8-hour shift. Before the Manitowoc 4500 came on the job, output was limited to 1600 yards each shift, excavated by two shovels — a 1½-yd. and a ¾-yd. unit.

Saves $200 a day

Use of the big 4500 has cut labor and operating costs by more than $200 a day. The drag handles a yard of dirt for 7 cents, compared to the 25 cents a yard with the old, two-shovel method — a saving of $230 a day, *plus* the increase in production! With the ore running 75 to 100 feet deep, the Manitowoc's lower cost per yard of material moved allows the company to mine at extreme depths and still show a profit.

Selective Mining Possible

Because of the Manitowoc's long reach and accurate control, selective mining is now possible — casting off the overburden to one pile and ore-bearing earth to another. Thus, the grade of ore obtained from "spotty" areas intermingled with overburden is improved. The shovels used previously could not economically reduce the amount of dirt mixed with ore.

Single Power Package

The Manitowoc 4500 offers big capacity with all the advantages of a single diesel power package. You get greater simplicity, more efficient utilization of power and more mobility. Unit drive eliminates involved electric motors, control boards, miles of wiring and the deadweight and wasted space this equipment requires. There's no restrictive cable dragging from the machine to prohibit mobility . . . no expensive power installations anywhere. The 4500 follows the ore to any spot on your mine.

There's much more to the profitable Manitowoc 4500 story. See your Manitowoc distributor for complete information on this amazing mining machine!

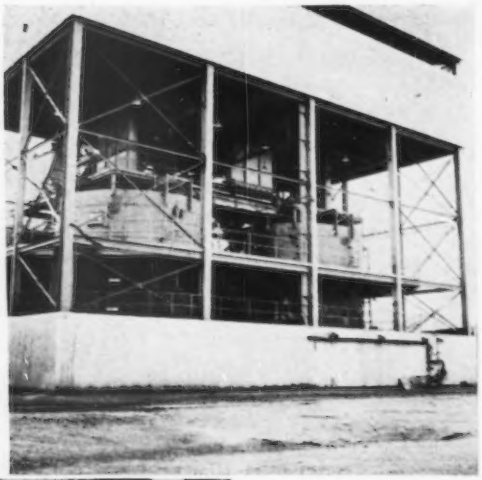
MANITOWOC ENGINEERING CORP., MANITOWOC, WIS.

SHOVELS 1-5½ YD.

Manitowoc

CRANES 20-100 TON

another large Copper Co. orders...



Installing 3, 23'-6" I. D., 4-Hearth Units

Photographs show a typical installation of two C.I.W. 23'-6" I. D., 4-hearth Skinner Dryers.

At this plant...

SKINNER DRYERS

- each unit is drying over 20 tons/hr. of copper sulphide concentrates
- reducing moisture content from approximately 15% to 9%.

Based upon successful results like this, another large copper company is installing Skinner Dryers.

experience...proved performance

Skinner...proved for 38 years for efficient roasting and drying of ores, clays, limestone, lime sludge...including sulphide roasting; oxidizing, reducing and chloridizing roasts.

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AKINS CLASSIFIERS • SKINNER ROASTERS • LOWDEN DRYERS

Sales Agents and Licensed Manufacturers in Foreign Countries

A SUBSIDIARY OF THE MINE & SMELTER SUPPLY CO.

Safety Law *(Continued)*

Major changes in the old regulations:

1) Tightened requirements dealing with gassy mines.

2) More stringent rules on protection from dust. (This is because silicosis or silicosis complications have caused more than 25% of the mine deaths.). New orders say workers have to be out of the mine before primary blasting. and

NWMA *(Continued)*

J. Towne, secretary; Amy Satterstrom, assistant secretary; and E. K. Barnes, H. E. Doelle, J. C. Kieffer, and D. E. Watson, directors.

On the Program

GENERAL

Report on the Lead-Zinc Situation. C. E. Schwab, chairman, Emergency Lead-Zinc Committee.
Role of the Bureau of Land Management in Minerals Development. Edward Woozley, director U. S. Bureau of Land Management.
The Price of Gold—Political and Economic Influences. G. D. Franklin, Yukon Placer Mining Co., Seattle, Wash.
Ideas, Incentives and the Mining Industry. R. M. Foose, Stanford Research Institute, Menlo Park, Calif.
Long Range Outlook for Minerals. A. W. Knoerr, editor *Engineering & Mining Journal*.

GEOLOGY AND EXPLORATION

Exploration in Alaska and the Role of the Territorial Department of Mines. P. R. Holdsworth, Alaska Department of Mines, Juneau, Alaska.
Iron Ore Resources of Southeast Alaska and Factors Affecting Utilization. J. A. Herdlick, U. S. Bureau of Mines, Juneau, Alaska.
Geology and the National Minerals Problem. Thomas B. Nolan, director U. S. Geological Survey, Washington, D. C.
History of Geology and Ore Deposits in Montana. M. H. Gidel, Anaconda Co, Butte, Mont.
Structural Geology of the Galena Mine. S. N. Kesten, American Smelting & Refining Co., Wallace, Idaho.
A Geologic Appraisal of DMEA Exploration in the Eastern Part of the United States. T. H. Killsgaard, U.S. Geological Survey, Washington, D.C.

MINING

The Incline Cryderman at Reeves MacDonald. John Parker, Reeves MacDonald, Ltd., Remac, B.C.
Driving the Ash River Tunnel. Leonard Belliveau, Belmont Construction Co., Vancouver, B. C.
Removal of Ripple Rocks. E. E. Mason, Vancouver, B. C.
Safety Program of the Mining Association of British Columbia. I. H. Sloan, Mining Association of B. C., Vancouver, B. C.
Dredging in Central Idaho. R. A. Lothrop, Porter Bros., Boise, Idaho.
Open Pit Methods. John Isbell, Isbell Construction Co., Reno, Nev.
Comparative Sand Fill Methods. W. E. Crandall and James Hunter, Helca Mining Co., Wallace, Idaho.

SHAFT SINKING SYMPOSIUM

The Lucky Friday Shaft. (Cryderman Mucker) W. D. Featherstone, Wallace, Idaho.
The Silver Mountain Shaft. (Riddell Mucker) W. H. Love, Hecla Mining Co., Wallace, Idaho.
The Crescent Shaft. (Riddell Mucker) E. B. Olds, Bunker Hill Co., Kellogg, Idaho.
The Page Inclined Shaft. (Cryderman Mucker) T. M. Tower, American Smelting & Refining Co., Wallace, Idaho.
The Sidney Shaft. (Hydromucker) C. A. McKinley, Sidney Mining Co., Kellogg, Idaho.

MINERAL EXTRACTION

Milling of Uranium Ore at the Ford Plant of the Dawn Mining Co. Don Hargrove, Dawn Uranium Mining Co.
History of Impounding Bunker Hill Mill Tailings. N. J. Sather, Bunker Hill Co., Kellogg, Idaho.
The Reeves-MacDonald Lead-Zinc Concentrator. J. C. Crampton, Pend Oreille Mines and Metals Co., Metaline Falls, Wash.
Status of Certain "Rare" Metals. A. J. Kauffman, Jr. U. S. Bureau of Mines, Albany, Ore.
The Zinc Blast Furnace. Joseph Newton, University of Idaho, Moscow, Idaho.
The Extractive Metallurgy of Magnesium and Ferroalloys in the Northwest. G. J. Fagan, Pacific Northwest Alloys, Spokane, Wash.
Use of Northwest Metals and Minerals in the Aluminum Industry. J. J. Wegner, Kaiser Aluminum & Chemical Corp., Spokane, Wash.

Airborne magnetometer survey plane over gold mines area near Johannesburg

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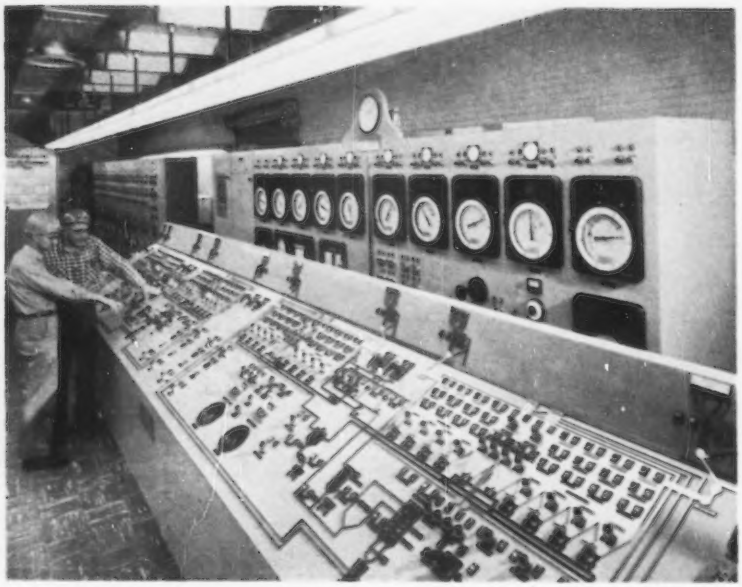


OPEN HEARTH electrostatic precipitator control room shows complexity of new $9-million fluorine recovery system installed by U. S. Steel's Geneva Works.

USS Unveils $9-Million Fluorine Plant

U. S. Steel's Columbia-Geneva Steel Division recently made public for the first time its $9-million fluorine recovery system at its Provo steel mill—Geneva Works.

News of the pollution control facility—in operation for the past two years—has been withheld pending judgement in damage suits filed by some 300 farmers in the area who claimed fluorine from the mill had damaged their livestock and crops. Altogether, 900 claims had been made, totalling almost $4.50-million. Chief complaint was that fluorine caused a cattle bone disease, fluorosis.

Columbia-Geneva's system, needed because of the high fluorine content of the iron ore used as mill feed, recovers fluorine by exposing smoke and hot air to lime dust, which collects the gaseous fluorine and converts it into solid particles, which are then removed by electrostatic precipitators. In addition to recovering more than 90% of the fluorine, harmless particles are removed from the smoke and dust, making the mill one of the cleanest steel plants in the world.

Along with the recovery system, company officials stated that Columbia-Geneva set up an agricultural department which studies the effect of fluorine on crops and livestock.

Safety Law *(Continued)*

during secondary blasting they must be protected by specified types of ventilation.

3) "More practical" regulations on powder magazines. For instance, a sand fill between walls can be used for bullet-proofing.

4) More comprehensive rules on hoisting equipment.

IN THE U. S.

ARIZONA

Copper prices below the point of profitable production have caused curtailment of output and working hours in Arizona's mining industry—a factor of great concern to a state which derives about 22% of its tax revenue from mining.

Greatest reduction has been by Phelps Dodge Corp., which has cut back by some 3,250 tons of copper per month. Biggest slice was at the Morenci Branch (1,600 tons) followed by the New Cornelia Branch (850) Lavender pit (500) and Copper Queen Branch (300.

Production cuts were achieved by a reduction of work schedules from 26 out of 28 days for open pit operations to 23 out of 26, and from 12 out of 14 days to 11 out of 14 for underground work.

Kennecott Copper Corp. made no significant production curtailments, but has started a program to reduce costs by about 10%. This may result in a curtailment at the Ray division of 700 tons per month.

Miami Copper Co. and Inspiration Consolidated Copper Co. have started major curtailment programs in the Globe-Miami area. Miami's fall production was about 3,159 tons monthly compared with 4,146 a year ago—a 23.8% curtailment.

Inspiration Consolidated has reduced output some 17%, down 700 tons per month.

Bagdad Copper Corp has made no production slashes but has eliminated overtime pay in an effort to stay within the market.

Magma's rich operation reports no cutback, with the year's output down only slightly at an estimated 22,000 tons of copper compared with 24,000 tons last year. Magma's subsidiary, San Manuel, is still working to reach its rated capacity of 30,000 tpd and is one of the few operations with an increased work force—2,500 men as compared with 2,200 a year ago.

San Manuel was brought into production under a Government contract providing a floor price of 24c a pound plus escalator for 347,500 tons of copper. During the third quarter of 1957 San Manuel sold 2,500 tons of copper to the Government. Total production for nine months ended Sept. 30, 1957, was 86,692,164 lb—up 32,846,300 over the same period of 1956.

Pima Mining Co., another new producer, also is increasing work force and production.

But with other small producers, the situation generally was one of reduction of production and work force and overtime wages.

CALIFORNIA

Kern Uranium Co. put its Little Sparkler mine on a standby basis as of Nov. 22, Lloyd Scouler, company president, reports. The Kern River operation was the first in California to produce shipment ore for processing.

"While our ore has been determined to be amenable to the existing process of a mill in Utah and although we are told both by the mill and the AEC that our ore is wanted, neither are presently in a position to take it," Scouler says. He adds he is confident that "this situation" will be resolved in the near future but that, in the meantime, active working of the mine has ceased.

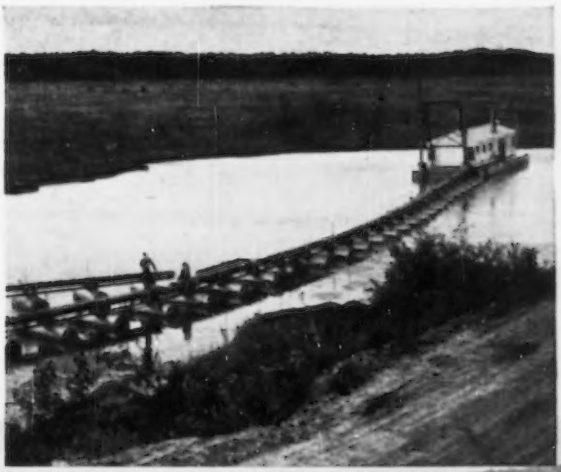
Rare Metals Corp. of America has purchased controlling interest in a lease on the Altoona quicksilver mine in Trinity County and will construct a 100 tpd mill on the property.

The 30-year lease, with 27 years to go, is held by Bert C. Austin and L. A. Smith, San Francisco mining engineers.

Smith said cash payment for Rare Metals' interest, plus retained interest in profit of the mine, might amount to $1-million over a period of years.

COLORADO

Leadville Lead Corp., doing exploratory work on property in the vicinity of its old Hilltop Mine near the top of Mosquito range and near the border line between Park and Lake counties, reports that it recently shipped some two hundred tons of silver-lead ore to the Leadville smelter. The ore ranged from



Turning Tailings into Ore!

This NAYLOR spiralweld pipe is being used in dredging operations to convert tailings into ore.

It's another example of the heavy-duty service you can expect from this distinctive lightweight pipe. It's easy to handle. Extra strong. Installs faster with the one-piece NAYLOR Wedgelock coupling. Sizes from 4 to 30 inches in diameter.

Write for Bulletin 507 which tells the complete story.

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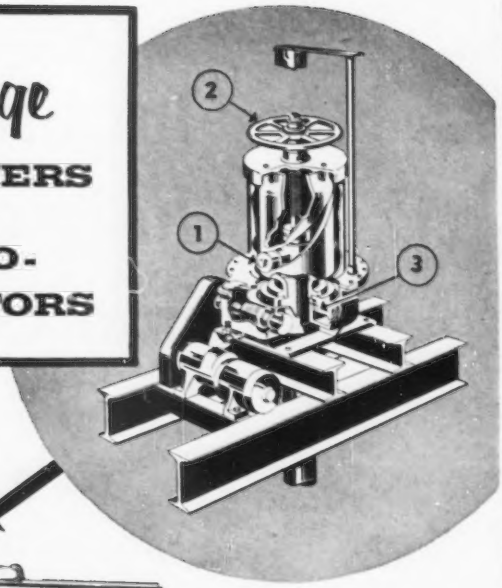
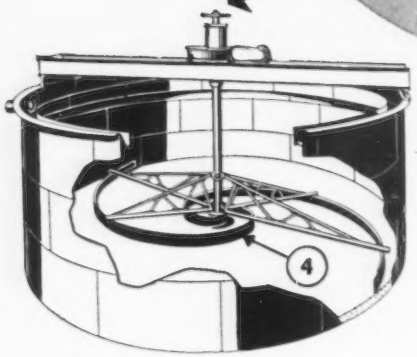
THICKENERS and HYDRO-SEPARATORS





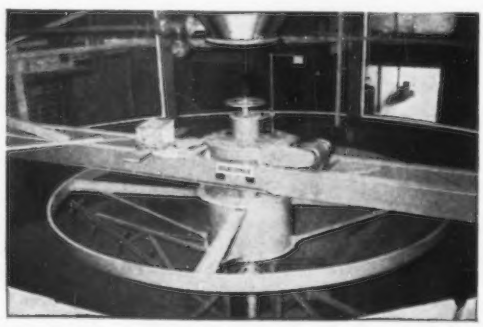
. . . for all clarifying, thickening and de-sliming operations.

For flotation concentrates thickening ahead of filtering—or for tailings disposal or reclamation, Hardinge Thickeners provide:

1. "Auto-Raise" to avoid lost production from overloads.
2. Manual or power raise to supplement "Auto-Raise."
3. Replaceable ring-type ball bearing support for rotating mechanism.
4. Spiral rakes for maximum underflow density.

Also available are froth rakes for froth-free overflow and superposed type tank construction for minimum floor space and building economy. Complete specifications on request. Bulletin 31-E-1.

→



A 35'-diameter Hardinge Superposed Thickener installation in a Canadian lead-zinc concentrator. The sludge outlet for the upper unit can be seen at the top of the picture. Note froth ring on lower unit.

HARDINGE
COMPANY, INCORPORATED

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Colorado (*Continued*)

$70 to $90 per ton, but not enough work has been done to give any ore estimates.

S. Stokes Tomlin, president of the newly merged Shenandoah-Dives-Marcy Mining and Exploration Co., says his firm is reconditioning the Shenandoah mill for production by the first of the year. It will provide a central custom milling operation for other large and small mines around Silverton. Company will mill ore from 100 or more of its own claims.

Officials of Grand Junction's Beaver Mesa Uranium, Inc. have announced plans to increase the firm's current uranium ore production rate. According to Beaver Mesa president, Alan M. Simpson, the current 6,000 tpm rate will have to be doubled to extract most of known ore reserves before March 31, 1962—the date when an assured market price as established by the AEC will expire. Beaver Mesa has purchased new mining equipment and machinery totaling $80,000 in order that the production level can be increased as soon as possible.

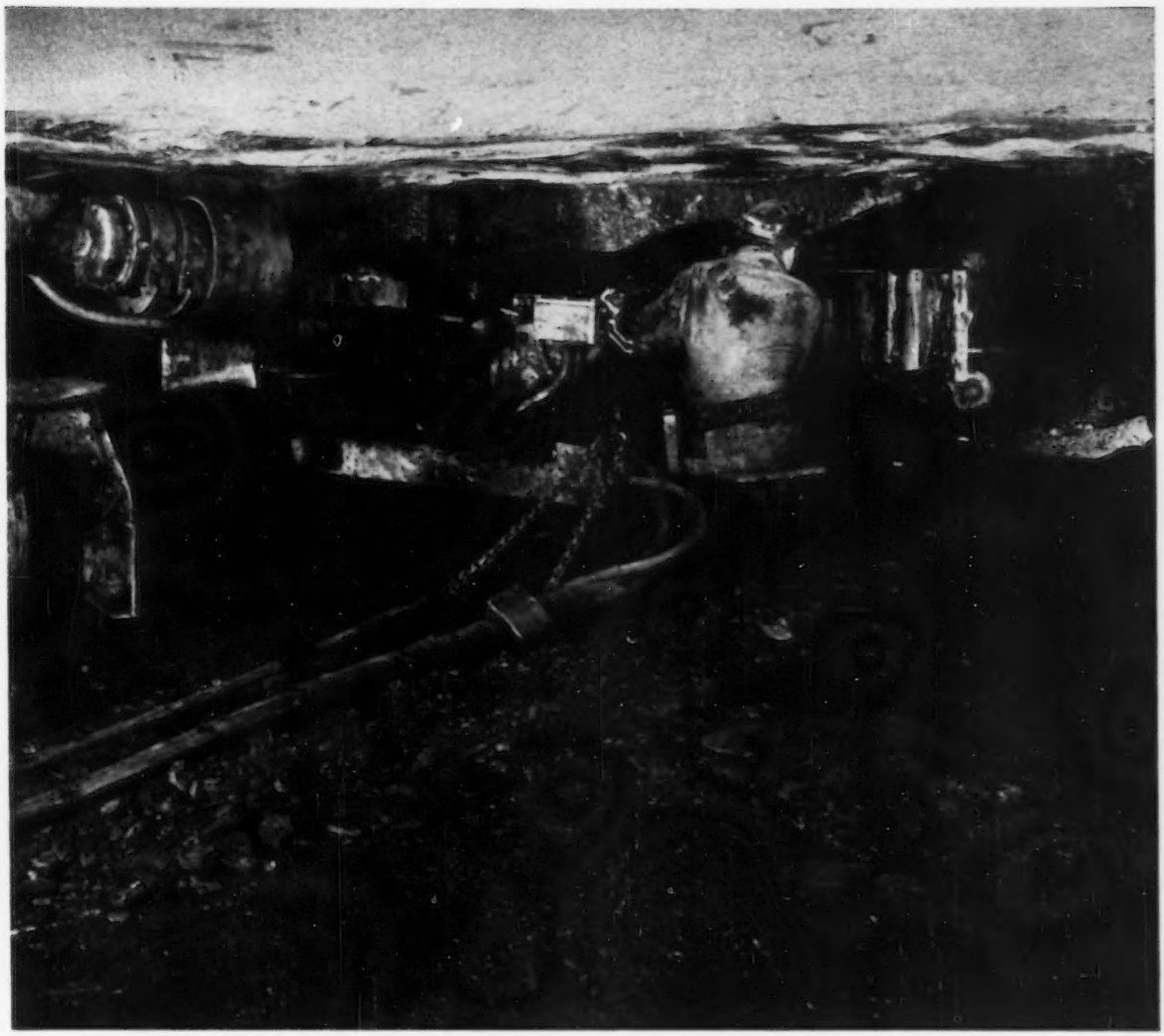
American Smelting & Refining Co.'s Globe Smelting Plant in Denver was host to approximately 400 people recently, including employees, their families and other guests. Dual purpose of the open house was to mark the opening of new storage, mixing and calcining departments, and to recognize the completion of one year's operations without a disabling injury. Visit included displays prepared by plant personnel, showing the history of Globe from 1895, safety equipment and products of various departments.

E. W. Windolph, business manager for Stony Point Development, Inc. of Denver says his company and the Champa Mining Co. have entered into a "joint venture" arrangement for the mining of a large iron-oxide deposit in Clear Creek county, about 14 miles northwest of Grant, and for the erection of a plant at Golden for processing the ore.

Property and equipment of the Humphreys Investment Co. applicable to its Engineering Division, together with certain other property, was transferred Oct. 31, 1957 to Humphreys Engineering Co., a subsidiary incorporated under the laws of Colorado, formed for the purpose of carrying on the business previously undertaken by the Engineering Division.

IDAHO

Bunker Hill Co. of Kellogg has purchased the old Red Bird Mine in Custer County, near Clayton, an early-day producer once operated by Ford Motor Co. It was bought from Louis Buchman, Lester S. Breckon and Joseph A. Norden, all of Salt Lake City, who acquired it from the Ford interests in 1946, and have since extracted about 25,000 tons of ore averaging about 14% lead and 10 oz of silver per ton.



How to reduce stop-and-go mining

Every time a machine is out because of cable failure, what choice do you have? Either you lose production or you must subject the other equipment used to handle the load of the disabled machine to excessive wear and tear.

But now you can minimize the downtime due to cable failure of continuous mining machines, cutting machines, conveyors and loaders. With Rome portable parallel duplex power cable, you're sure of longer working periods, even under the most grueling mine conditions. Here's why:

1. An open fibrous braid around each power conductor provides 360° of balanced adhesion to the Rome 60 (neoprene) sheath.
2. This braid also minimizes the individual movement of the conductors within the sheath when the cable is twisted or flexed.
3. The specially compounded Rome 60 (neoprene) sheath is highly resistant to acids, alkalis, oils, abrasion and flame.
4. For tire-like toughness that gives extra protection against mechanical damage, the Rome 60 sheath is vulcanized in a continuous lead mold.
5. Extra overload protection is provided by heat-resistant rubber compound insulation suitable for maximum continuous operation at 75C.

The next time you have to replace a portable mining machine cable, call your Rome Cable distributor. You'll be more than satisfied with the service Rome's cables will provide. Contact your nearest Rome Cable representative for more information—or write to Department 510, Rome Cable Corporation, Rome, New York.

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Thanks to

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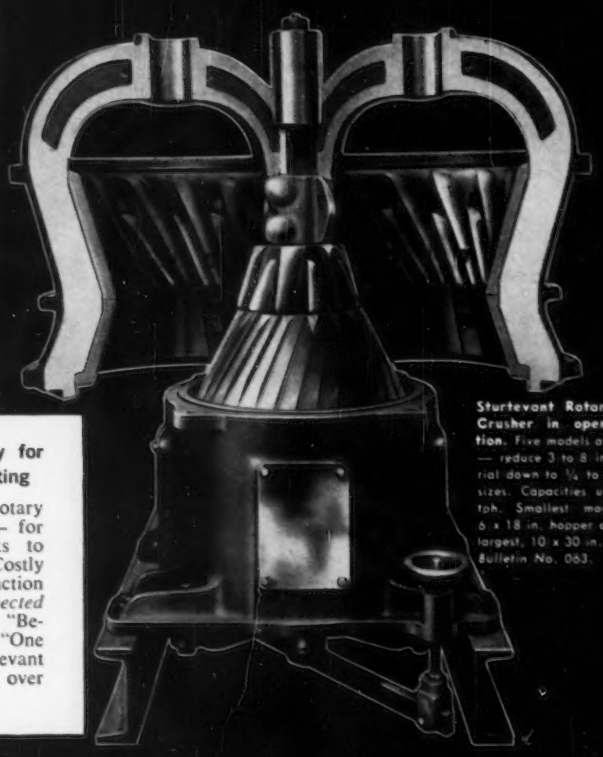

Sturtevant Rotary Fine Crusher in open position. Five models available — reduce 3 to 8 in. material down to ¼ to 1¼ in. sizes. Capacities up to 30 tph. Smallest model has 6 x 18 in. hopper opening; largest, 10 x 30 in. Request Bulletin No. 063.

"One Man, One Minute" Accessibility for Inspection, Clean-outs, Trouble-shooting

One man can swing open a Sturtevant Rotary Fine Crusher in a matter of minutes — for inspection and maintenance — thanks to Sturtevant's unique "Open-Door" design. Costly downtime is cut to a minimum, production kept on schedule — *even when the unexpected happens.* Little wonder that users say: "Because of their rugged construction and "One Man, One Minute" accessibility, Sturtevant machines give us *lower* operating costs over *more* years."

STURTEVANT ROTARY FINE CRUSHERS REDUCE SOFT TO SEMI-HARD MATERIALS FASTER, MORE ECONOMICALLY

For uniform crushing of soft (clay, charcoal) to moderately hard materials (softer limestone, cement clinkers), the Sturtevant Rotary Fine Crusher is practically non-clogging — much faster than other machines, less costly to operate.

Smooth production flow. The single turning of a hand wheel regulates the output size (from ¼ to 1¼ in. on largest model) — provides a uniform product, dustless operation, steady output for greatest production efficiency.

A lifetime of low-downtime service. Built into Sturtevant Rotary Fine Crushers is Sturtevant's 83 years of successful engineering of dry processing units and equipment. Rugged construction, plus easy accessibility provided by Sturtevant's unique "Open-Door" design, assures more output per machine year.

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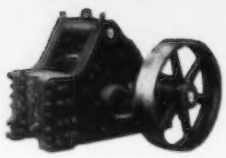
Dry Processing Equipment

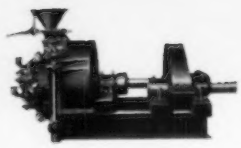
The "OPEN-DOOR" to *lower* operating costs over *more* years

CRUSHERS • GRINDERS • MICRON-GRINDERS • SEPARATORS
BLENDERS • GRANULATORS • CONVEYORS • ELEVATORS



JAW CRUSHERS

Reduce coarse (5 in. largest model) to fine (⅛ in. smallest model). Eight models range from 2 x 6 in. jaw opening (lab model) to 12 x 26 in. Capacities to 30 tph. All except two smaller sizes operate on double cam principle—crush twice per energy unit. Request Bulletin No. 062.



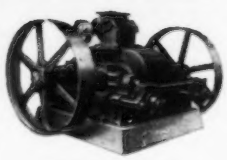
RING ROLL MILLS

Reduce hard or soft 1½ in. and smaller material to from 6 to 200 mesh. Grind only — no screens. Capacities of 3 models range up to 18 tph, depending on model and material. Ring diameters and faces 24 x 7 in.; 45 x 8 in.; 44 x 14 in. Request Bulletin No. 079.

ALL STURTEVANT MACHINES ARE DESIGNED TO OPERATE ADVANTAGEOUSLY IN "UNITS"

HAMMER MILLS

Reduce to 20 mesh. Swing-Sledge Mills crush moderately hard material up to 70 tph. Hinged-Hammer Pulverizers crush softer material at rates up to 30 tph. Four Swing-Sledge Mills with feed openings from 6 x 5 in. to 20 x 30½ in. Four Hinged-Hammer Pulverizers from 12 x 12 in. to 12½ x 24 in. Request Bulletin No. 084.



CRUSHING ROLLS

Reduce soft to hard 2 in. and smaller materials to from 12 to 20 mesh with minimum fines. Eight sizes, with rolls from 8 x 5 in. to 38 x 20 in.; rates to 87 tph. Three types — Balanced Rolls for automatic adjustment in operation; Plain Balanced Rolls; Laboratory Rolls. Recomended for 3 to 1 reduction. Request Bulletin No. 065.

Idaho *(Continued)*

Stockholders of Day Mines Inc. have been advised by management that development results this year at the company's Gold Dollar gold-silver mine in Ferry County, Wash., near Republic have been much better than expected, and it is anticipated that the new ninth and tenth levels will be much more productive than those above. Property is operated by Knob Hill Mines Inc. under lease. No official statements about ore values in the new lower workings have been released, but unofficial reports of $300-per-ton ore and better have been circulating freely in Spokane mining circles.

Conversion of the Bunker Hill company's plants at Kellogg to natural gas fuel got under way in mid-November and was expected to be completed shortly after the first of the year. The changeover would not include the lead smelter blast furnace and the zinc-fuming plant because coal and coke are needed for these facilities to provide the desired chemical reaction. Switch to gas makes Bunker Hill the first major user of this fuel in the Coeur d'Alenes. Daily consumption was scheduled to amount to some 4,450,000 cubic ft. when conversion was completed.

ILLINOIS

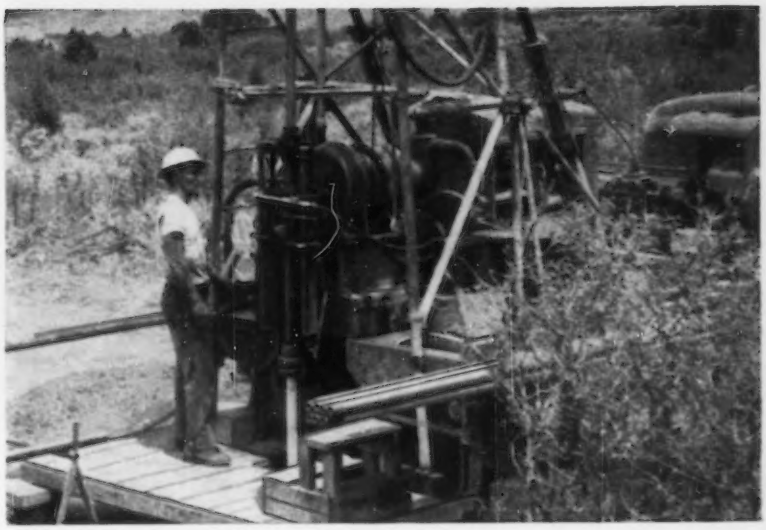
During recent weeks, geologists and engineers, representing various mining and fluorine chemical companies, have been traversing the length and breadth of the Illinois fluorspar mining area, making a general investigative survey of ore reserves and the industry's potentials. Among the company representatives engaged in the run-down of the district were: Owen Kingman, Tennessee Copper Co.; Paul Herbert, Tri-State Zinc Co.; Robert Fulton and Robert Grogan, Du Pont Co.; James B. Lee, Kaiser Aluminum Co.; F. B. Kern, Union Carbide Nuclear Co.; John Kellogg, consulting engineer, Aspen, Colo.; and Pauline Moyd, geological consultant, Mt. Vernon, N. Y.

Sinking of a new 145-ft shaft at the Deardorff fluorspar mine, in the Cave-in-Rock district of Hardin County, was started in December by Ozark-Mahoning Co. It's the second shaft to be constructed on the Deardorff property, and work is under contract to J. W. Patton and Sons, of Elizabethtown.

IRON COUNTRY

Loading ore on the Mesabi range was concluded Dec. 1 when a train of 140 carloads was sent to the Great Northern docks at Allouez, Wis., for the steamer George M. Humphrey. No further boats are expected at the Duluth-Superior harbor for this season. Temperature Dec. 2 was four degrees below zero.

Rail shipments of iron ore from the Gogebic range to the ore docks at Es-



One of the many drill rigs now in operation throughout the United States and overseas.

The most important primary phase of construction, roadbuilding or mining begins with foundation investigation or exploratory work from which it is desired to get complete information and best possible cores. In many instances, contractors make the mistake of bidding on work or taking a contract without complete knowledge of sub-surface conditions, or miners will start mining operations without first conducting a thorough exploration program, but successful contractors and mining men always investigate first to know how to quote in order to get the contract and still make a profit, and how to plan to have a successful operation. One of the most reliable organizations in America for furnishing this information and satisfactory cores is Sprague & Henwood, Inc. For more than seventy years it has been rendering satisfactory core drilling service throughout the United States and the world. Many of its customers have continuing contracts with Sprague & Henwood, Inc., because they know that they can be assured of the best in foundation investigation and core drilling service that can be found anywhere.

Sprague & Henwood, Inc., with its own manufactured field tested drilling equipment; its own manufactured "Oriented" diamond bits; its highly trained personnel; and its well trained and highly qualified supervision assure you of the best possible results obtainable.

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Iron Country *(Continued)*

canaba and Ashland, Wis. and direct to furnaces at Duluth and Granite City were slightly higher in total tonnage than last year: 4,359,474 tons in 1957 vs. 4,359,053 tons in 1956.

The iron ore shipping season in the Iron River district ended Nov. 26. The Menominee range shipped more than 5-million tons this season, but did not reach the anticipated 6-million tons. At Crystal Falls, the Tobin mine of Republic Steel Corp., which closed down in October with a large stockpile on hand, was the last mine to finish shipping. The docks at Escanaba ended the season Nov. 27, six days earlier than last year. The docks handled about 5,925,000 tons which include some ore from the Gogebic range.

Ray D. Nolan, state director of the Minnesota's Lands and Minerals Division, reported that, for the three months ended last Sept. 30, $2,232,845. was received by the state from ore royalties and rentals from state owned lands. 2,777,000 tons of ore were taken from 29 mines on state lands. A report of June 30, 1957, showed nearly $290-million in the state trust funds.

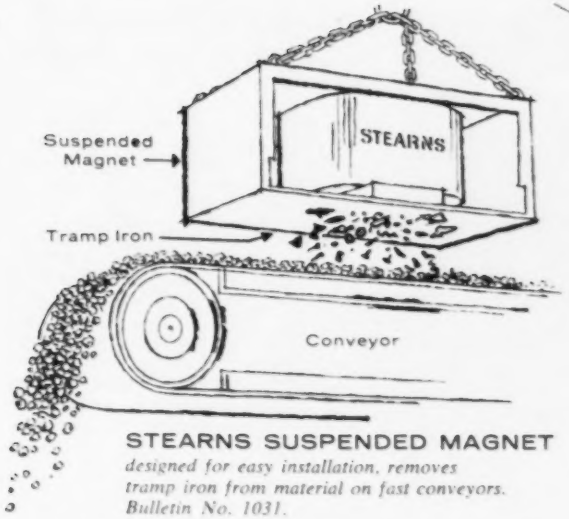
Young-Montana Corp. has finished loading iron ore for this season from its Willow Creek open pit mine near Stanford, Montana, after shipping 26,288 tons of high grade ore.

During the week ended Nov. 25, 492,964 tons of ore was shipped from the Duluth-Superior docks. Total shipments for the season to that date were 84,439,976 tons—more than 9½-million tons above 1956 on that date.

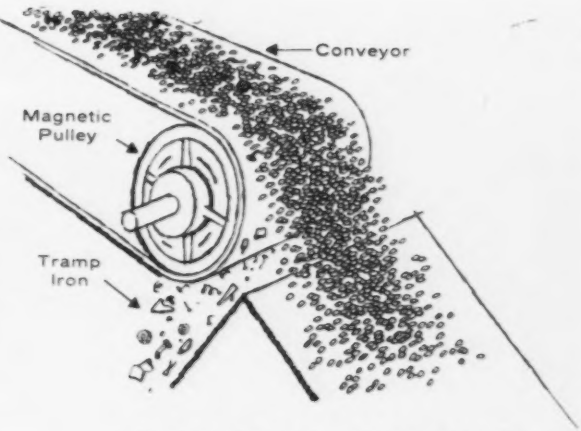
Reserve Mining Co.'s shipments of taconite pellets were expected to have exceeded 5-million tons in 1957, while total shipments from the three plants (Reserve, Erie Mining and Pilotac were about 6-million tons.

At the Engineers' Club of Northern Minnesota meeting held in Chisholm on November 13th, the speaker was A. J. Haley, director-mineral-development department of the Great Northern R. R. The Great Northern is undertaking a research of non-magnetic taconite concentration in cooperation with the Ford Foundation and the University of Minnesota Mines Experiment Station. Great Northern's interest is as an ore carrier; it is not an owner of taconite lands.

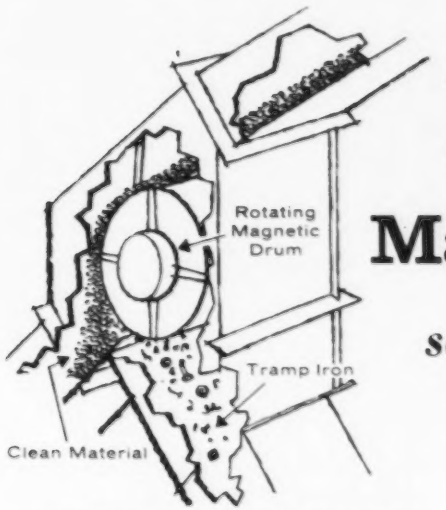
As the 1957 shipping season drew to a close, R. T. Elstad, president of Oliver Iron Mining Division, estimated that Oliver shipments for the season would be about 34½-million tons, 4-million tons higher than last year. High grade concentrates produced from low grade ores and taconite amounted to nearly 7-million tons of total shipments. Mr. Elstad said that every ton of ore shipped by Oliver last year was treated, either by crushing, sizing or concentrating. He predicted a "high level of employment" for Oliver's 6,700 men this winter. Stripping program for the winter will be one of the largest in recent years.



STEARNS SUSPENDED MAGNET
designed for easy installation, removes tramp iron from material on fast conveyors. Bulletin No. 1031.



STEARNS MAGNETIC PULLEY
at head of conveyor line removes tramp iron continuously, efficiently, automatically. Bulletin Nos. 303D and 350C.



STEARNS MAGNETIC DRUM
automatically removes tramp iron from flowing material in spouts and chutes. Bulletin No. 93E.

STEARNS Engineered Magnetic Protection

solves your tramp-iron problems

Whatever your product — however it flows — on belts, in chutes or ducts or pipe — magnetic separation of troublesome tramp iron can be a built-in feature of the line. Stearns engineers can help you get the most efficient protection for your present conveyor or any new system you're planning.

These men are specialists — representing a company with more than 40 years of leadership in design and application of magnetic equipment. They will work with any conveyor manufacturer you designate — or with your own plant engineering staff — to design the ideal installation for your particular process.

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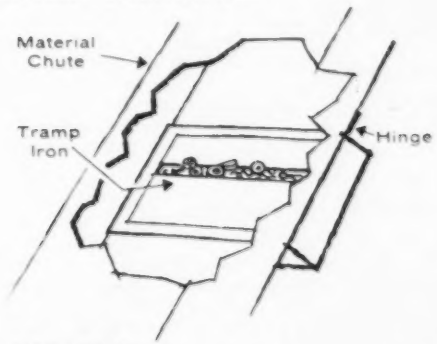

STEARNS "MAGMAN" PLATE MAGNET
efficiently removes tramp iron from material in chutes, spouts, ducts or on conveyors. Bulletin No. 1071D.

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Quaker conveyor belting installation used in ore mining.

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Quaker conveyor belting is especially designed for carrying highly abrasive materials such as mine ores, trap rock, shales, and machined metal parts. The heavy-duty cover resists sharp abrasion and extra wear caused by material caught between boot pulley and belt. Quaker belting is resilient—engineered to withstand the high flexing of short centers and the tension of long hauls. It is constructed with extra-tough covers and carcass to resist severe impact.

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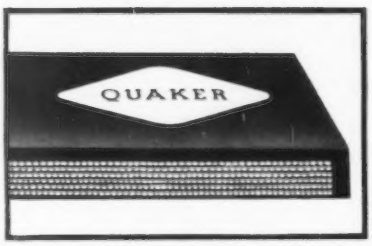

Cross-section Quaker No. 1 grade conveyor belt: 6-ply N-50 heavy cotton-nylon fabric, skim-coated between plies.

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on Quaker belting, containing information on performance, specifications, and sizes, write to QUAKER RUBBER DIVISION, H. K. PORTER COMPANY, INC., Phila. 24, Pa., or Pittsburg, California.

H. K. PORTER COMPANY, INC.
QUAKER RUBBER DIVISION

Iron Country *(Continued)*

Oliver had 14 beneficiation and crushing-screening plants in operation this year and two additional units will be added next year: a new heavy media unit at the Trout Lake plant and a new spiral unit at the Arcturus plant in Marble, which will recover 125,000 to 165,000 tpd of fine ores.

Pittsburgh Steamship Division's 57 vessels transported a total of 21,737,000 tons of iron ore from Duluth and Two Harbors, Minnesota to lower lake ports during the 1957 shipping season, Admiral Charles R. Khoury, president of this U. S. Steel Division announced.

This exceeds by more than 6-million tons the total shipped last season when operations were hampered by a seventy-day work stoppage.

MONTANA

Lease of some uranium claims of the Pryor Mining Co. to the Midland Mining Co. was recorded in the office of county clerk of Carbon County.

Involved in the transaction were the Pearl Lode mining claim, the east 900 ft of the Bud Lode mining claim, and the north 600 ft of the Mine Lode Claim. Midland also is allowed to use such part of the Rose Lode claim as may be necessary for storage and camp site.

The lease is for 10 years. Pryor is to receive a royalty of one-eighth of gross proceeds, including bonuses, or one-half of the net profits, whichever it may elect. Midland agrees to do all necessary work in operation of the claims, including assessment work necessary to hold the claims under mining laws.

New mill constructed by Merger Mines Corp. at the old Snowshoe mine near Libby, for concentrating lead-silver ore also will recover a quantity of gold, according to C. H. Hunter, president of the firm. Some gold will be recovered, but the values have not been figured close enough to include in estimated profit margins. An estimated 17,000 tons of ore is available for milling at the property. The mill is located about five miles from the mine. It is being planned for year-round operation. Equipment installation work is in final stage and project is nearly completed.

NEVADA

White Caps Mining Co. has struck a large deposit of antimony, much of it high grade, at its White Caps mine near Manhattan in Nye County. Vein is below the 400-ft level, according to Harry Hughes, company geologist and engineer. He estimates that 2,000 tons of ore is high grade, running from 50 to 60%. Another 8,000 tons will assay from 15 to 17%, according to estimates.

Donavan Mining and Milling Co. at Silver City has struck a deposit of gold-

First Choice
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KENNEDY CRUSHING MACHINERY

#42 KVS Primary Gearless Gyratory Crusher with cast steel frame

No matter what ore you handle, there is a KVS crusher made for your needs. Engineers who know, the world over, use KVS equipment because of its economical operation, rugged construction and adaptability for processing a wide range of materials.

EXCLUSIVE FEATURES OF THE KVS GEARLESS GYRATORY CRUSHER

- Synchronous motor built into the pulley assembly —or V-belt drive if you prefer.
- Smooth, frictionless operation—there are no gears.
- Power is used only for crushing.
- All moving parts are carried on roller bearings.
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- Self-aligning ball and socket eccentric.

Consult today with a KVS sales engineer about your crushing problems.

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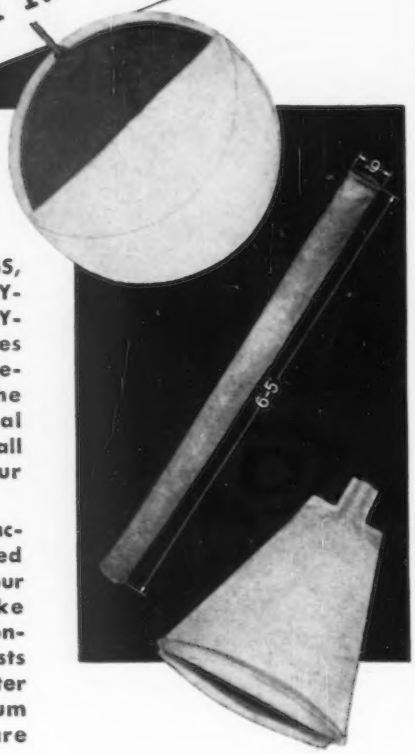
Let US make up your Element Coverings from NFM Filter Media



NFM Filter Media are woven from treated Cotton, VINCEL†, SARAN, DYNEL, GLASS, DACRON††, TEFLON*, POLYETHYLENE, ORLON*, AND POLYMAX†. This wide range insures your obtaining the type of element covering having the greatest degree of chemical resistance and best general all round performance for your particular operation.**

NFM element coverings are accurately and durably fabricated by skilled personnel at both our New Haven and Salt Lake plants. Experience has demonstrated that filter cloth costs are at a minimum and filter performance at a maximum wherever NFM products are employed.

If you are not absolutely certain as to which type of synthetic or natural fiber is best for your use send us a complete description of your operating conditions and we'll be glad to make a recommendation. Our many years of experience mean that we have quite a fund of knowledge always at your disposal.

*TM for DuPont Acrylic Fiber
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Pensacola, Fla.: Chem-Quip Co., 1102 Texar Drive

Nevada *(Continued)*

silver ore showing a value of $10 to $17 per ton, according to William Donovan, head of the firm which is the only remaining active operation on the Comstock Lode. Donovan has pursued the orebody for several years, milling $6 to $7 per ton ore at a profit. Mining is done by the strip method, and it will be necessary to remove 40,000 tons of overburden to reach the new find.

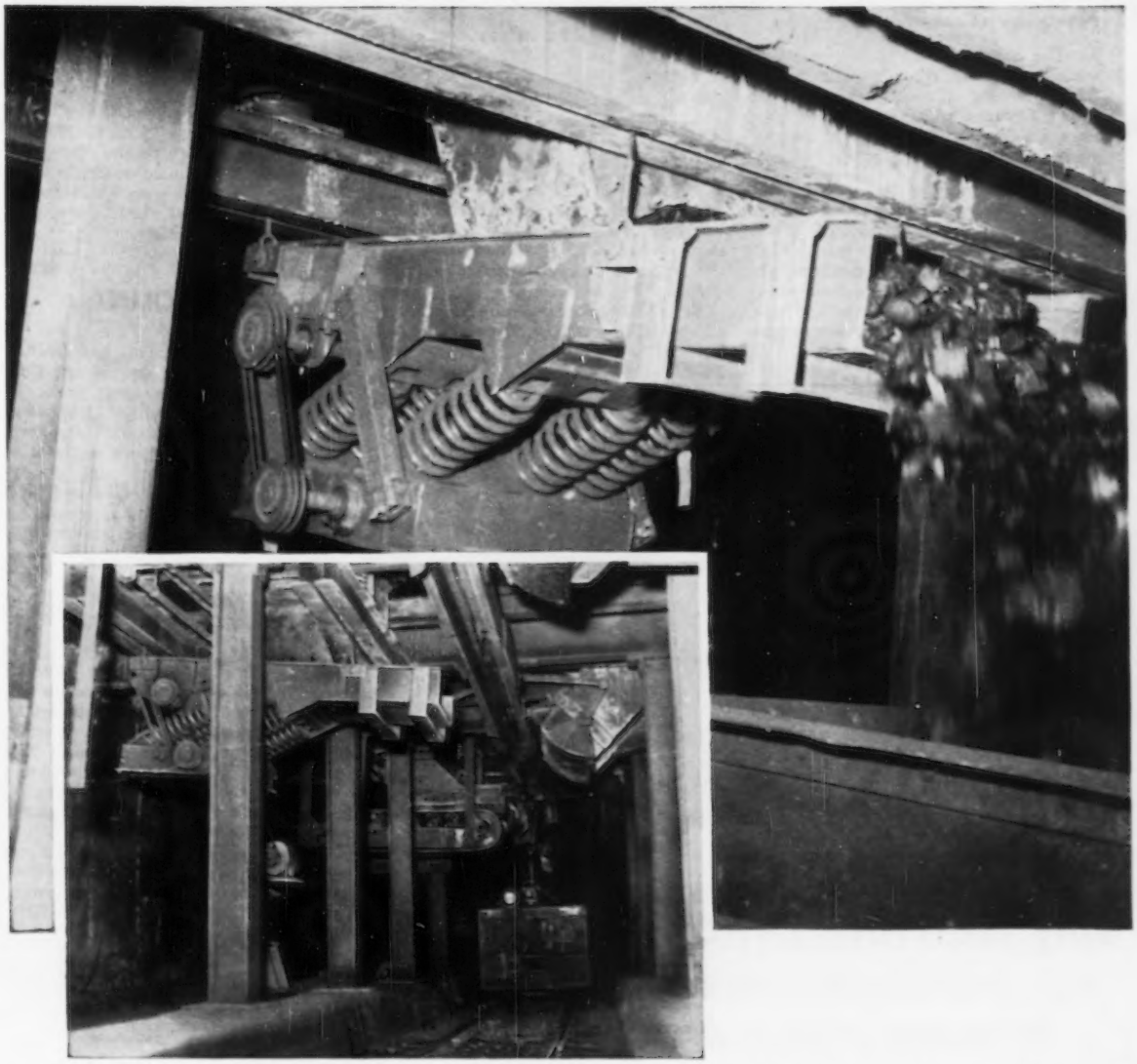
Titanium Metals Corp. at Henderson laid off 200 employees Dec. 1. The action was attributed to Government cancellation of aircraft contracts. A company spokesman said most aircraft plants have enough titanium on hand to complete present contracts. The cutback was the third work force reduction at the plant during 1957. A total of 215 employees lost their jobs earlier in the year.

U. S. Gypsum Co. is stockpiling large tonnages of perlite ore at the firm's Kodak mill, four miles east of Lovelock along the Southern Pacific tracks. John Pedro, who has the mining and hauling contract, is directing strip mining operations with a power shovel in the Trinity range seven miles north of Lovelock. At the Kodak mill the ore is crushed and sent through a cleaning and classifying plant after which it is stored in bins or loaded on box cars for shipment. Some is being sent to U. S. Gypsum's big plant at Empire, in northern Washoe county, where plaster and plaster board are made.

Combined Metals Reduction Co. is still producing perlite at its Caselton mine and mill in Lincoln county. Formerly one of Nevada's largest lead-zinc producers, it is now operated by a skeleton crew. Six men are employed at the mill, a mile west of Pioche, and six others are working at the perlite pit, 16 miles away. Perlite is hauled by truck to the Caselton mill where it's crushed and sized, and then sent by rail to distant perlite producers for final refining.

Twenty-five feet of .2% uranium oxide ore has been hit by the Apex Mining Co. in a cross-cut from raise No. 2 in the Rundberg Mine near Austin, according to company officials. The vein was struck 50 ft below the Rundberg level at a depth ranging from 165 to 185 ft and a raise will be driven to connect the new ore with Rundberg orebody. In another part of the property, a diamond drill hole southwest of the No. 2 adit has cross-cut 50 ft of ore that shows an indicated content of .25 to .70% uranium oxide. Apex is the only producing uranium mine in Nevada, and the only one negotiating a contract with the AEC.

Construction of a secondary road from the Cordero Mine to McDermitt in northern Humboldt county is assured following opening of bids by the Nevada Highway Department on Dec. 5. The project involves rebuilding Route 619 for a distance of 11 miles to connect the big mercury producer with Highway



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Nevada (*Continued*)

95. The contractor will be allowed 200 working days to complete the project from the time a notice to proceed is issued. Cordero, which is Nevada's largest quicksilver producer, provides heavy year-around use for the access route.

Copper Trio Inc. has leased the Sodaville leaching plant three miles east of Luning from John Sinkey, of Mina. L. A. Smith, of Lovelock, manager of Copper Trio, said the mill facilities will be used to leach copper ore from properties in the Luning area which have been under development for some time. Mill is 12 miles from the mine, and haul is all downhill. Its capacity is 200 tpd, and sulphuric acid for the leaching process will be shipped from the Pacific coast.

NEW MEXICO

A new mineral discovered near Grants, has been named Santafeite in recognition of the Santa Fe Railway's pioneer exploration and development of uranium deposits in that area.

Dr. Ming-Shan Sun, mineralogist for the New Mexico State Bureau of Mines and Mineral Resources, and after six years of study, classified the mineral. A complete paper on his findings will be published early this year (in "The American Mineralogist").

The new mineral, described as a hydrated vanadate, was found in 1951 on an outcropping of Todilto limestone near Haystack Mountain where, in 1950, uranium-bearing ores were discovered on lands whose mineral rights are owned by a railroad subsidiary.

NORTH CAROLINA

Carolina Pyrophyllite Co., has finished work on a large dam and 14-acre lake on Bowling Mountain, near Stem, in continuing development of long-range plans for commercial use of pyrophyllite deposits which, in this area, lie close to the surface. The water will be used in processing the pyrophyllite and land has been acquired for a processing plant, although plans for building the plant have not been disclosed as yet.

OREGON

Spokane, Wash. office of the Defense Minerals Exploration Administration has announced approval of two exploration projects in Oregon. One is a contract for $10,420 with the International Engineering and Mining Co. for exploration of the Axehandle mercury mine in Jefferson county. DMEA participation will total $7,815.

Other project is a contract with Ford M. Converse to explore for copper at Jackson County's Grand Cove mine. The $7,200 contract provides for 50% DMEA participation.

Wah Chang Corp.'s new $500,000 zirconium purification plant at Albany, went into full operation Nov. 21, just after Oregon Metallurgical Co., also in Albany, announced a $4-million contract to deliver zirconium ingots to Westinghouse Electric Corp.

Oregon Metallurgical and the zirconium division of Wah Chang will work together in filling the Westinghouse order.

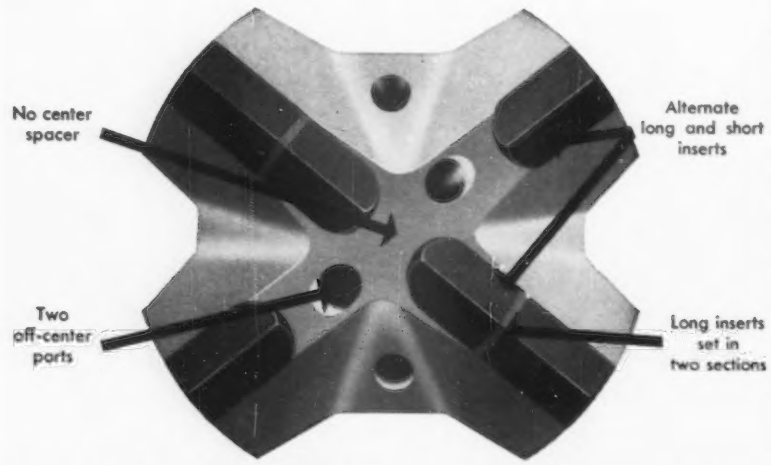
Wah Chang's plant reduces zirconium chloride to zirconium oxide and hafnium through a washing process. The hafnium is turned over to the Bureau of Mines where it is processed for the AEC. Zirconium oxide goes into Wah Chang's reduction plant for final reduction into zirconium sponge.

At Oregon Metallurgical, zirconium sponge is melted and machined into zirconium ingots.

TEXAS

American Sulphur Co. announced the start of plant construction to work the Humble Dome near Houston.

Company officials did not disclose the cost of construction, nor did they announce sulphur reserves present in



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Texas *(Continued)*

the dome. They did say, however, that the dome, a former oil well site, contained sulphur in "commercial quantities."

UTAH

Radorock Resources Inc.'s Radon mine in the Big Indian district is consistently shipping some of the highest grade uranium ore ever produced in the United States.

During six months ended Oct. 31, 1957, the firm produced some 33,334 dry tons of ore with an average grade of 0.815% U_3O_8.

Gross ore sales from this tonnage amounted to $2,959,600, according to Ralph W. Neyman, president and general manager at Salt Lake City. Radorock is 52% controlled by Federal Uranium Corp.

International Smelting & Refining Co., 100 percent controlled by Anaconda Co., announced a "severe economy program" at properties in western United States.

F. A. Wardlaw, Jr., Salt Lake City, IS&R general manager, said that the move resulted from lowered prices.

He said that some forces located at general offices in downtown Salt Lake City would be moved to company-owned quarters at Tooele, Utah, lead-zinc reduction center.

Stearns-Roger Manufacturing Co. is engaged in qualification testing of the 800-tpd uranium mill of Texas-Zinc Minerals Corp. at Mexican Hat, San Juan County.

Texas-Zinc, joint affiliate of the Texas Co. and New Jersey Zinc Co., expects to take over operation of the mill from contractor Stearns Roger in December. The mill employs solvent extraction process and has been abuilding during 1957.

The operation is distinguished in the uranium business by necessities of constructing expensive access road into the White Canyon district of Utah and extension of power lines into a new area over rugged terrain. Texas-Zinc also built an 80 tpd H_2SO_4 plant utilizing Gulf Coast brimstone as feed.

Some 120 persons will be employed at the mill.

Two professors at University of Utah believe there will be no civilian market after Dec. 31, 1966 for domestically-produced uranium ores.

They are Drs. Armand J. Eardley, dean of the College of Mines and Minerals Industries and George Richard Hill, head of the University's department of fuel technology.

They reported in a recent issue of the Utah Economic and Business Review, published by the school's College of Business, that, by 1966, the U. S. will have an excess supply of some 185,000 tons of natural uranium in Government stockpile.

They say that needs of domestic steam electrical generation from nuclear powered reactors in the next nine years will not be sufficient to meet anywhere near the production of uranium metal from domestic ores and concentrates.

WASHINGTON

Daybreak Uranium, Inc., announced at the end of November that it had shipped a total of 3,800 tons of uranium ore to the Ford processing plant of Dawn Mining Co.

Daybreak, a Spokane mining firm, said the ore was valued at about $84,000, but net to the company will be about $72,000 after royalty payments.

Firm is now shipping ore at the rate of about 540 tons per week. Daybreak's stockpile at its Mount Spokane mine was estimated at 3,000 tons and ore is being mined from the open pit operation at the rate of 200 tons a week. Meanwhile, development work is being continued at company's mine on the Spokane Indian reservation.

Earle B. Gibbs, Colville, has taken over operation of the Red Top mine in northeastern Stevens county. Gibbs is running the mine under a lease and purchase option.

He reported a new strike of lead-

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5810

NEW HEADQUARTERS for the Linatex Company of America has been located at Stafford Springs, Conn. Personnel made the move to the expanded plant this month.

Washington *(Continued)*

silver-zinc ore at the property. Gibbs has begun to mine the ore and about 200 tons have been hauled to the Bonanza mill near Colville. Crude ore will be sorted for direct shipment to the Bunker Hill smelter at Kellogg, Idaho.

Utahcan, Inc., Spokane mining firm, has a mill under construction at a new lead-zinc-silver property west of Ione. The property is only about 20 to 25 miles south of the Metaline mining district of northeastern Washington.

WYOMING

Curtailment of Colorado Fuel and Iron Corp. operations at Pueblo, Colo., apparently will not have an immediate effect on the CF&I iron mine at Sunrise.

Supt. M. L. Sisson said he had received no orders for a further cutback in mining operations.

Prior to CF&I's cutback at Pueblo, the Sunrise mine had laid off 26 men and shifted to a 4-day work week, cutting production from 3,000 to 3,300 tpd to 2,500 tons.

Another hurdle for Columbia-Geneva's proposed development of low grade iron ore deposits near Atlantic City, has been cleared with the Yellowstone River compact commission's decision not to oppose diversion of five cubic feet of water from the drainage.

Yellowstone River Compact commission is composed of representatives from Wyoming, Montana and North Dakota. The original compact prohibited diversion from Yellowstone drainage.

Columbia-Geneva plans to divert five cubic feet of water per second from the Little Popo Agie River to the Sweetwater River in connection with its proposed $16-million beneficiating plant. The Sweetwater drains into the North Platte river.

Columbia-Geneva has said it will announce next April if it will go ahead with plans for the development. Iron ore obtained from the Atlantic City deposits would be upgraded at a new mill and the ore shipped by rail to Provo, Utah, blast furnaces.

Rissler and McMurray, Casper, have started work on a project to strip 250,000 cu yd of overburden from the Valley Dean Corp.'s open pit mine in the East Gas Hills.

When the operation is completed, more than a million cubic yd will have been stripped from the Redwood open pit mine. The new stripping project will be an extension to the southwest of present pit which lies on the Bountiful No. 1 claim.

Sen. Joseph C. O'Mahoney (D-Wyo.) said he is asking the budget bureau to include appropriations in the next budget for Federal aid for constructing access roads to uranium producing areas.

"Meanwhile, I hope some provision for access roads can be made in the first deficiency appropriation to be acted upon when the new session of Congress begins," O'Mahoney said.

Wyoming uranium industry leaders have asked for construction of a 110-mile network of hard-surfaced roads, linking the Gas Hills area with Riverton, Casper and Jeffrey City.

Food Machinery and Chemical Corp. has been awarded leases on 4,973 acres of Federally-owned sodium deposits near Green River on a bid of $5.05 per acre.

One 2,556 acre tract is located 13 miles west of Green River and the remaining 2,417 acres are 15 miles west of the city.

Federal Uranium Corp. has formally presented its much-discussed proposal for a uranium mill in the Gas Hills District of Fremont County.

Ralph W. Neyman, Salt Lake City, president of the company and affiliated Radorock Resources, Inc., said Federal's proposal to the Grand Junction Operations Office of the AEC envisages a 500 tpd concentrator utilizing the "Infilco" process, a continuous resin-in-pulp circuit.

IN CANADA

QUEBEC

Discovery of another large iron orebody in the Ungava Peninsula of Quebec is announced by Paul H. D'Aragon, president of Quebec Explorers Corp. Ltd.

D'Aragon states the Quebec government has granted the company an exploration permit covering approximately 100 square miles in the Lake Armand area, 25 miles west of Diana Bay, 15 miles south of Dyke Head on Hudson Strait, and 60 miles north of holdings of International Iron Ore Ltd., the project of the Cyrus Eaton interests.

Although it is difficult in the present stage of exploration to evaluate the exact tonnage of iron ore, D'Aragon estimated that it could be of the order of about 100-million tons of iron ore formation per square mile. The ore is all magnetite, he said, and large outcrops in many places indicate that open pit mining is possible.

Shareholders of Eastern Mining and Smelting Corp. Ltd., meeting in Quebec City, have approved a three-company merger to exploit extensive nickel reserves.

Eastern Mining will merge with Nickel Rim Mines Ltd. and Canalask Nickel Mines Ltd. The shareholders also approved purchasing leases and mineral rights now owned by Trebor Mines Ltd.

New company, with head offices in Chicoutimi, Quebec, will be called Nickel Mining and Smelting Corp.

An expanded program has been planned by East Sullivan Mines for its extensive holdings and interests in the Mattagami Lake area. Initially, work is being concentrated on a large group of claims, comprising some 12,000 to 15,000 acres, in the southwest section of Cavelier Twp, some 10 miles southwest of the major base metal discovery owned by Mattagami Syndicate. Diamond drilling has already been started and detailed ground surveys are also under way to follow up results obtained by airborne geophysical survey. Diamond drilling is also planned for a group of claims in Isle-Dieu Twp.

Quebec Chibougamau Goldfields has suspended work on its copper-gold property in the Chibougamau area. Underground workings are being kept unwatered should decision be made to resume operations. Uncertainty of the outlook for copper was given as reason for the move.

Diamond drilling is to start in the new base metal discovery of Belleterre Quebec Mines, 20 miles north of the company's Mud Lake area gold mine. A limited amount of surface work has indi-

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Quebec *(Continued)*

cated nickel, copper, and zinc mineralization within a heavily oxidized zone.

BRITISH COLUMBIA

Western Copper Mills Ltd. started construction on its $8.5-million copper mill on Annacis Island in November, with production scheduled for late 1958.

Annual capacity is 18,000 tons, with industrial and domestic products to include seamless copper, brass and bronze tubing for condenser and heat exchangers, refrigeration, automotive and marine service; copper tubing for domestic water supply; busbars for high and low tension switchgear installations; complete line of brass rods and shapes; and copper rods for local wire and cable mills.

Tabulation by the B.C.-Yukon Chamber of Mines shows that within the past year 14 mines "of consequence" have closed down, plus a number of small operations. Over the past six years about 26 mines have closed.

Among those that have stopped operating in the past 12 months are: Argonaut, Silbak Premier, CM&S's silica mine at Hedley, Kelowna Hedley, Granby at Copper Mountain, Giant Mascot, Cody Reco, Carnegie Mines, Slocan Van Roi, Mid-West Copper, Woodgreen Copper and Western Explorations' Silverton operation. Surface explorations at the CM&S Sullivan mine have also stopped.

Various reasons lie behind the shutdowns including low metal prices, high operation costs, dwindling ore reserves and what mining men consider as excessive taxation and legislation by the government that impedes mining development.

Possibility of increased lead and zinc tariffs, now under discussion by the U. S. Government, could easily put a few more mines under, Elliott said. He predicted that unless many conditions improve, the mining picture will continue to worsen in 1958.

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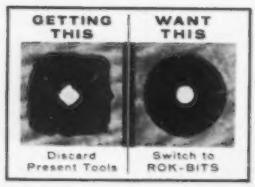

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NEW BRUNSWICK

According to recent official report, ore reserves at Heath Steele Mines in the Newcastle area are estimated at 4.7-million short tons averaging 3% lead, 7.2% zinc, 1.1% copper and 3.3 oz silver per ton, plus an additional 2.7-million short tons averaging 1.3% lead, 3.6% zinc, 1.4% copper and 2.0 oz silver per ton. Heath is a subsidiary of the American Metal Co., which holds 75% interest.

ONTARIO

Claim staking in Ontario in 1957 was well below that of the previous year. In the first 11 months, the Ontario Department of Mines reports that number of claims staked amounted to 29,759, a drop of 16,870 from the total of 46,629 recorded for the same period of 1956. Activity was centered largely in the Patricia and Kowcash district, Port Arthur and Sudbury districts.

The M. A. Hanna Co. began construction of the first taconite plant to be operated by the company at Moose Mountain, Ontario, in March of this year and plans completion in May, 1958. It will employ about 170 men, and ore will be shipped by rail to Depot Harbor on Lake Huron. Moose Mountain is about 35 miles north of Sudbury. The orebody was known in the early 1890's and was developed in a small way from 1906 to 1915 with some shipments being made.

Stanrock Uranium Mines has moved the date for start of milling operations ahead one month to mid-February at its Blind River uranium mine. Originally the schedule called for the 3,300-ton capacity plant to start operations late November 1957, but water difficulties in shaft sinking led to extension of target date to March 15. The new date has been made possible as a result of record advances in the sinking of the two shafts.

Norpax Nickel Mines is carrying out a deep diamond drilling program at its nickel-copper prospect in the Werner Lake area.

Uranium Reduction standardizes on KREBS CYCLONES for sand-slime separation

Uranium Reduction Company, Moab, Utah. One of the 14 U. S. Uranium Plants using Krebs Cyclones

Multiple banks of Krebs D6B and D10B Cyclones are used for complete counter current washing of the fine sand-slime separation at Uranium Reduction Company, Moab, Utah. Final overflow product from D6B Krebs Cyclones goes to the RIP circuit at minus 20 microns at the rated 1500 TPD capacity. Very fine sands of the isolated CCD cyclone systems, consisting of banks of D10B Krebs Cyclones, join the coarser sands to the tailings. The Metallurgists and Superintendents of Uranium Reduction visited Equipment Engineers Pilot Plant at Palo Alto, California, to observe full unit scale studies which were subsequently duplicated in the Moab plant. We invite your inquiry on the possible application of cyclone classification to your operation and offer the services of our Pilot Plant for full scale investigations.

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IN LATIN AMERICA

CHILE

La Africana flotation mill near Santiago is now treating 500 metric tpd of 3.5% copper ore and on Nov. 8, made its first shipment of 1,000 tons of 28% copper concentrate to Tacoma smelter. La Africana is owned by Santiago Mining Co., one of the three Anaconda subsidiaries in Chile.

Callejas & Sons, owners of the Farellón Sánchez copper mine and mill (500 tpd), have given notice to its workers of their decision to shut down the mine because of copper's low price. Other medium size mines which might be compelled to close down for the same reason are: Cerro Negro, 400 tpd; Tocopilla, 350 tpd; Merceditas, 200 tpd; and Cerrillos, 400 tpd.

The Central Bank has approved a loan of $450,000 to the Mining Credit Bank to enable the organization to keep buying ores and concentrates from the small mines at a loss, as present schedules are based on a price of 29.5c per lb for copper.

Interest in buying Chilean high-grade iron ores in lump form for open-hearth furnaces, keen until recently, has slackened off appreciably by U. S. steel companies. This lack of interest coincides with the U. S. steel industry's falling off from 105 to 80% of capacity.

MEXICO

Mexico, which last year produced 360,000 metric tons of barite, expects to produce 400,000 tons this year, most of which will be for export to the U. S. This mineral compound is used primarily for heavy oilwell muds but also it is consumed by several branches of the chemical industry.

Petroleos Mexicanos, the government's petroleum agency, consumes between 45,000 and 60,000 tons annually. Practically all of the remainder is sent by train to Texas oilfields. Mexican production is expected to continue its growth beyond the 400,000 ton annual output.

Mercury mining in Mexico, which rises and falls with the thermometer of world prices, is continuing at a rate which assures Mexico of third place as a world producer of this metal.

Trailing the output of Italy and Spain, Mexico in 1956, the last year for which complete statistics are available, produced 19,531 flasks, valued at more than $5-million. Most of this was exported, primarily to the U. S. The 1957 production is expected to be only slightly lower.

Mexico's all-time mercury production

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A set of Yieldable Arches consists of curved U-shaped sections nested together and overlapped enough to permit clamping with husky U-bolt clamps. The clamps control the degree of tightness of the joint, and permit yielding when the forces exceed the load for which the joint was intended. Each Arch set is tied to adjoining sets by means of horizontal struts, which add lateral rigidity to the structure.

Besides increasing mine safety, the Yieldable Arch offers high salvageability, and usually pays for itself within its first year of service. A Bethlehem engineer would like to discuss the Yieldable Arch with you —in terms of your own roof problems. You can reach him through the nearest Bethlehem Sales Office.

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Mexico *(Continued)*

occurred in 1955, when 29,858 flasks were produced. But, in 1956, when prices in New York fell $27 dollars a flask, many marginal producers were closed down. Nevertheless, current production still is a far cry from the 3,757 flasks Mexico produced in 1950.

PERU

A loan of more than $8.5-million will be made by American Overseas Finance Corp. for the development of the Acari iron ore deposits in Peru (*E&MJ*, November 1957, p 214). Announcement was made in Lima by Norbert A. Bogdon, president of the firm.

A $5-million loan will be made to Pan American Commodities, S.A., of Lima, for development of the deposits, and a further $3.5- to $4-million to the constructing company.

IN AUSTRALIA

Australian producers of rutile consider that the worst stage of their fight for higher prices is over but price increases are unlikely to materialize before June 1958. Even then, it is expected that the price increases will be mild.

Australian Development N. L. earned record profit of £A489,608 in its fiscal year ended June 30 compared with £A388,772 in the previous year. Sharp rise in profit was due mainly to the increase in tonnage of treated tailings. Mine ore treated was 30,112 tons (30,327) for a return of 42,495 (42,426) oz of gold but treated tailings rose from 6298 tons to 13,688 tons for 8898 (3549) oz of gold and about 47,000 tons of tailings remain to be treated. Positive ore reserves are 142,800 long tons (140,500) averaging 28.5 dwt (29.0) dwt.

Another Tasmania mine, Renison Associated Tin Mines N. L., has increased its profit in last fiscal year from £A8283 to £A19,054. Treated ore rose from 9153 to 10,431 tons averaging 1.47 (0.87)% tin for 139.7 (101.06) tons tin concentrate. Ore reserves have increased to at least five years' supply at present rate of production.

Montana Silver-Lead N. L. in Tasmania has been offered an initial attractive contract for 1,000 tons of nickel-copper concentrate. Prospecting work uncovered two profitable orebodies known as the Nickel Reward and Cuni North. Eight drill holes on the Nickel Reward gave 7 to 8% nickel and 2 to 5% copper values. Orebody is near the surface and can be largely mined by open pit methods. Greater silver-lead production is expected at the Montana mine when the 300 ft level is opened up. South drive on 200 ft level has been extended 150 ft in rich underlying ore.

Mt. Isa Mines Ltd. and Consolidated Zinc Ltd. are jointly prospecting a huge area between Mt. Isa and Darwin. It is understood that several promising lead and copper prospects are being examined as well as at least one promising uranium prospect.

United Uranium N. L. has started preliminary work on the construction of a treatment plant. Negotiations are under way with U. K. A. E. Authority for sale of uranium oxide. Fourth shipment of pitchblende was made in December and extracting pitchblende ore from the Palette mine is understood to have disclosed more lode material than previously estimated.

Crescent Rutile N. L. produced 400 tons of rutile and 600 tons of zircon during its running-in period and is now producing 80 tons of rutile and 100 tons of zircon a week. A recent company sale involved 1250 tons of rutile.

Kaniere Gold Dredging Ltd. of New Zealand, which started operations in May 1956, shows a net profit of N. Z. £24,787 for its fiscal year ended March 31 and comprising only 10½ months of operations. Value of ground treated was below expectations; 9,145 oz of bullion were recovered from 3,772,000 cubic yards treated.

Exploration and development in its last fiscal year increased the ore reserves of Mt. Isa Mines Ltd. (controlled by American Smelting & Refining Co.) in Queensland by more than 50%. The

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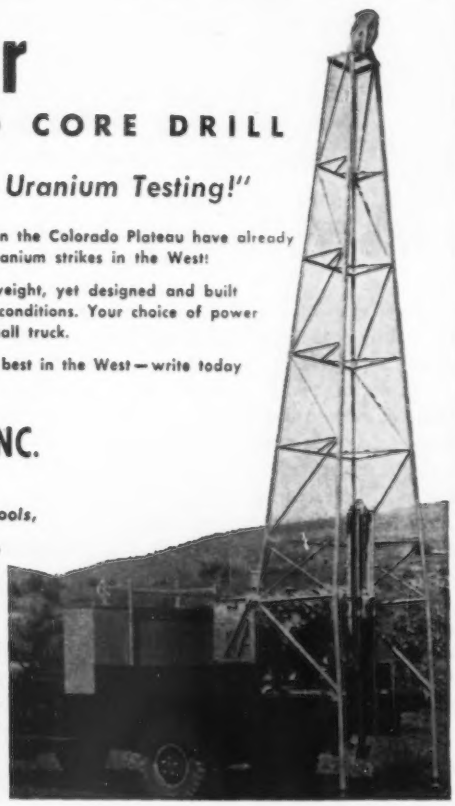

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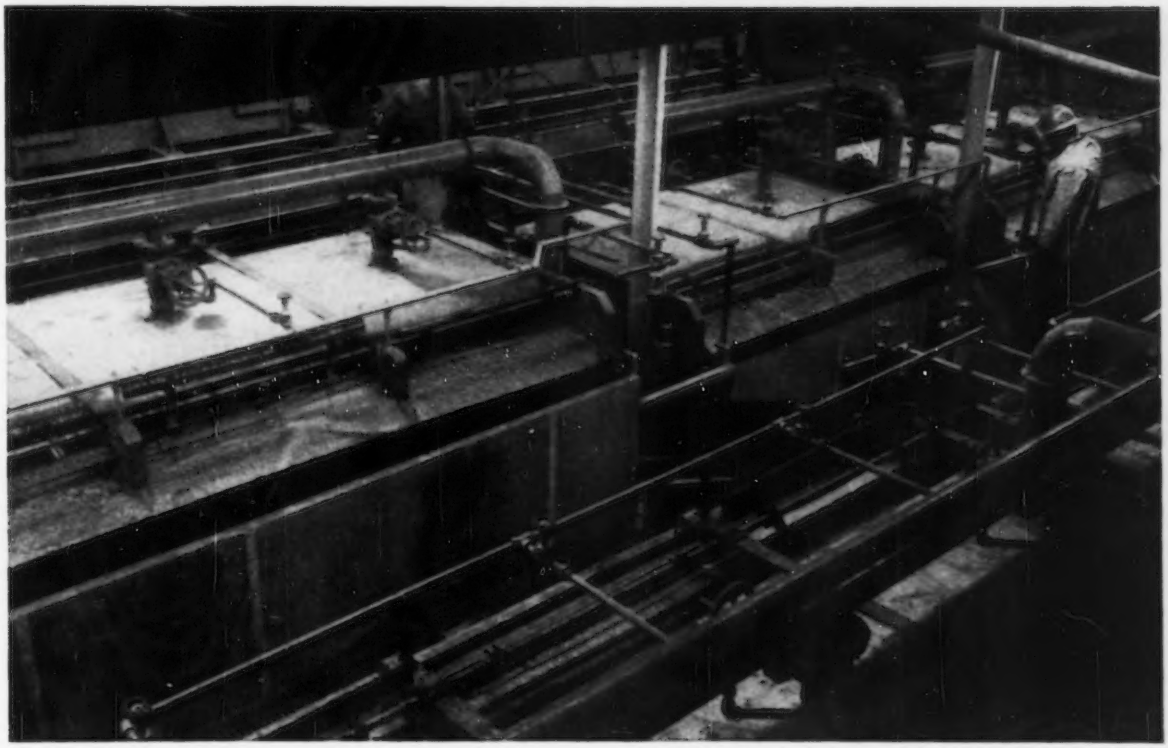

MODERN PIONEERS—The Cleveland-Cliffs Iron Company in Michigan is one of the pace setters in the conversion of low grade, nonmagnetic iron ore into a high iron content product. Pamak fatty acid is being used in the flotation phase of beneficiating the specular hematite material on the Marquette Range of Michigan.

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Australia *(Continued)*

addition is estimated to be 6.5-million tons of silver-lead-zinc ore and 5-million tons of copper ore. An interesting lead prospect on the Reward claim near McArthur River Station in Australia's Northern Territory is being currently investigated by shaft sinking and diamond drilling. Metal production last year rose to a record 45,190 tons of lead bullion, 35,404 tons of zinc concentrates and 28,875 tons of blister copper.

Interesting results were obtained from Mt. Isa Mines' Copper Smelter's full-scale tests to determine whether the addition of limestone to the furnace charge would effect smelting economies. The plant was run for alternate four-week periods with and without limestone. Results show that additions of limestone (5% on the roaster feed) had the following effects:

(a) gave improved bath conditions and faster smelting rate

(b) reduced the fuel ratio from 4- to 3.5-million Btu per long ton solid charge

(c) reduced the copper content of reverberatory slag from 0.42- to 0.38% Cu by reason of higher SiO_2 and lower Fe in the slag and uniformly good bath conditions

(d) enabled smelting of a higher tonnage of custom ores and domestic oxidized ore.

No bidding for operation of the Surigao nickel deposits took place. It appears that the reason was unfavorable terms stipulated by the government. One of the terms required the contractor to give the government 5% of the quarterly gross receipts or 50% of the net, whichever was higher. About 15 firms from Europe, U. S., and Japan had registered interest in the deposits, but made no bids.

Lepanto Consolidated stepped up its copper production in October, milling 38,700 tons containing 2,459,000 lb copper and 3912 ounces of gold in 4300 tons of concentrates. Ore milled during the month averaged 3.35% copper and 0.13 oz. gold per ton.

Atlas Consolidated milled 338,534 tons of copper ore in October, averaging 0.71% copper. Copper in 7,037 tons of concentrates produced totalled 3,659,000 lb. Shipments during the month totalled $950,000 in value. In addition, the company shipped 2,400 tons of pyrite to the National Power plant, and 10,150 tons of iron ore from the Mati deposit, valued at $95,000. Combined value of all shipments was $1,070,000.

IN THE PHILIPPINES

Philippine copper producers have asked government assistance to counteract prevailing low prices for their metal. They recommend 50% reduction of rates of duties on imports of equipment and supplies and more liberal barter privileges.

Mineral shipments from Philippine ports during the first nine months of 1957 were generally ahead of same period in 1956. Principal metal products are reported as follows (1956 in parentheses): Copper ore 29,706 tons (5,294), copper concentrates 108,247 tons (88,906), chrome ore 513,213 tons (528,712,) iron ore 1,081,006 tons (1,040,230), manganese ore 15,450 tons (2,000), zinc concentrates 1,624 tons (770). All copper ore was sent to Japan, and about two-thirds of the copper concentrates, with balance to U. S.

IN EUROPE

ITALY

Technicians of the National Commission for Nuclear Research are surveying large areas of the Italian Alps, Trentino Region, in an effort to delimit large uranium deposits believed to be present in the area.

First surveys are reported to be satisfactory. Though Commission is reluctant to release information on this matter, reliable reports indicate that Trentino promises to be one of the richest uranium regions in Italy.

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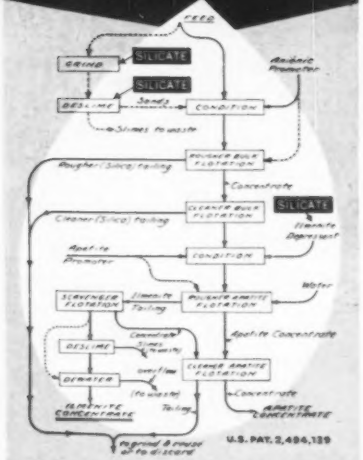

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GERMANY

A 100,000 ton ore deposit containing an average of 0.1% uranium oxide has been discovered by the mining company, Gewerkschaft Brunhilde, in the Nahe Region near Ellweiler. Ore can be mined by open-pit methods which would keep production costs comparatively low. Experimental mining at the Weissenstadt (Fichtelgebirge) deposit was discontinued recently since underground mining of ore containing only 0.5% uranium proved too expensive.

CZECHOSLOVAKIA

Czech geological teams on an all-year prospecting tour have reportedly found rich uranium deposits in the abandoned silver mines of 'Katharinenberg,' and others in the 'Bohemian Forest' and near Pribram, a West German source stated last month. The new deposits are said to be a welcome addition to the major uranium ore center at Krusne-Hory.

Seventeen days after putting the first Czech research reactor into use, the Czech press announced that the unit was operating at full capacity, yielding 2,000 kw. Greatest stress was laid in Czech reports on the alleged fact that 'the quality of the equipment and its careful assembly were amply demonstrated by the fact that no defects have been ascertained in this exceptionally complicated equipment.'

AUSTRIA

A process modified from the Austria-developed "oxygen blast" steel refining method, turned out by the Vereinigte Oesterreichische Eisen und Stahlwerke A. G., permits the utilization of iron with a high phosphorous content.

Two years of tests by the United Austrian Iron and Steel Works (VOEST), currently released facts that pig iron with a high P-content can be turned into the same grade of high-quality steel.

A roasting oven of 10,000 metric tons annual capacity will be built by the Bleiburger Bergwerks Unions's sulphuric acid plant, to bring up total capacity to 30,000 metric tpy. A long-term plan calls for the building of a fourth oven (also of 10,000 tpy) after a sufficient supply of ores has been assured.

USSR

Diamond deposits recently discovered in Yazly (East Siberia) are **far superior to the South African diamond deposits,** according to a statement made by the Russian Minister of Geology, Peter Antropow, and reported by Tass.

Antropow also stated that this discovery closes the only gap hitherto existing in Russian mineral resources. On the basis of the numerous mineralogical discoveries of the last years, USSR now claims to have the richest mineral resources of the world.

Russia plans to triple iron-ore extraction to 250 to 300 tons annually during the next 15 years.

Quoting *Pravda*, Soviet news says Russia now produces 35,000 tons of iron ore per annum. By 1975, the USSR will be producing 75 to 85-million tons of iron-ore and 100 to 120-million tons of steel.

Pravda says Russian iron-ore deposits are the largest in the world. "The existence of many new fields of iron-ore with favorable mining and geological conditions makes it possible already in the near future to set up big mining establishments," the newspaper says.

IN AFRICA

Total value of minerals produced in Northern Rhodesia in September this year was $19,885,600 as against $22,220,800 in September 1956. The total value of mineral production in Northern Rhodesia in the first nine months of this year is $205,114,000, a sharp decline from the figure for the first nine months of 1956 which was $271,054,000. The decline is accounted for almost entirely by the drop in the world price

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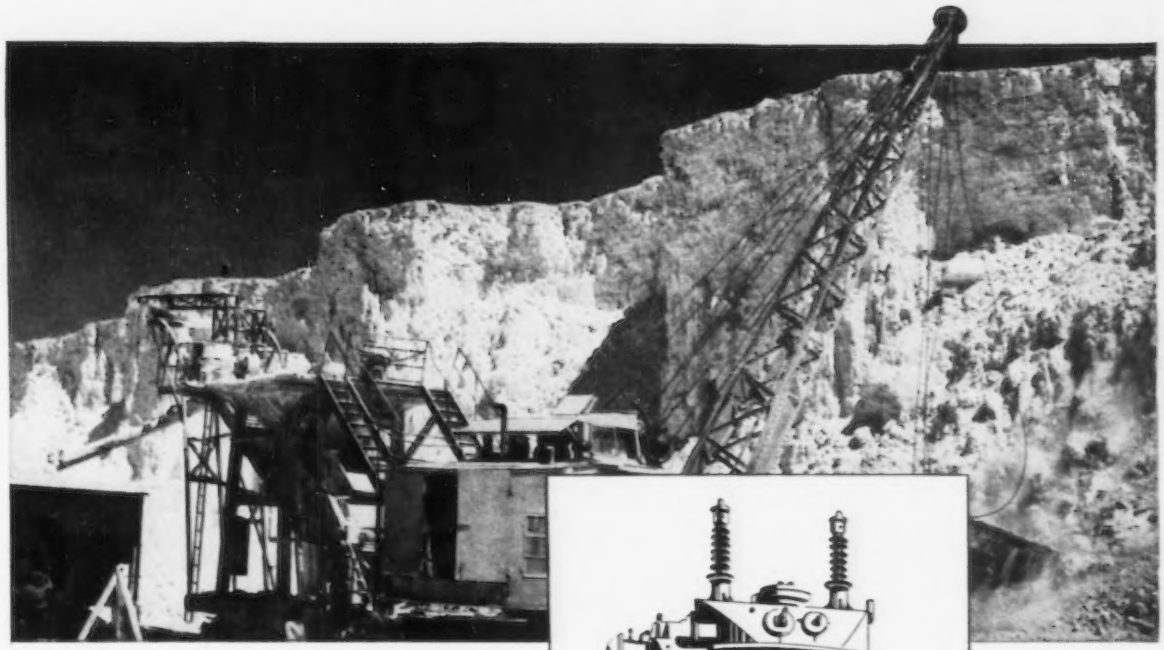

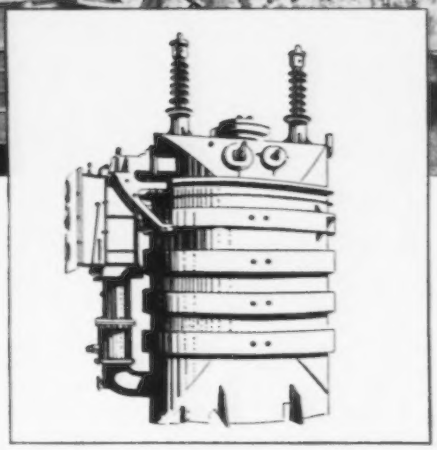

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Africa *(Continued)*

of copper, Northern Rhodesia's biggest export.

Federation of Rhodesia and Nyasaland is now exporting uranium oxide for the first time. Production of calcined uranium oxide began in May this year when a recovery plant for the treatment of uranium-bearing ore from Northern Rhodesia's Nkana Mine came into operation. For the period ending June 30th this year, Nkana produced 9,703 lb of uranium oxide containing 7,257 lb of U_3O_8.

IN ASIA

JAPAN

Japan's mining and manufacturing production index for the April-September period averaged 293.9, based on a standard of 100 for 1950, according to the Ministry of International Trade and Industry.

This figure represents an increase of 8.9% over the period from October 1956 to March 1957, and an increase of 18.7% over the corresponding period of the previous year.

Fuji Iron and Steel will shortly sign a contract with Russia for export of 20,000 tons of sheet steel, worth about 1,200-million yen.

This will be the largest export of this kind since the war. Last July, the firm contracted for export of 12,000 tons of sheet steel to the Soviet Union.

Egypt has asked the Japan Iron and Steel Federation to dispatch 41 steel technicians and skilled workers to that country to help operate an iron mill now under construction near Cairo. Japan is now studying the request.

Japan will shortly be invited to participate in international biddings in connection with the supply of materials and technicians for the projected Aswan Dam development venture.

Japan's Federation of Economic Organizations will shortly begin preparations for participation in the joint Japan-Brazilian project to build and operate an iron-steel mill in Minas Gerais, Brazil. The project was recently approved by Brazilian President Juscelino Kubitschek de Oliveira.

With a capitalization of 4,000 million cruzeiros (40% invested by Japan), the Minas mill will be one of Japan's largest post-war investment ventures abroad, and is expected to produce ultimately 500,000 tons of pig iron, 500,000 tons of crude steel, and 350,000 tons of steel products.

Representatives of Nisso Steel of Japan and other Japanese metal buyers have confirmed that all future output of ilmenite from the big Western Australian producer, Cable Ltd., will be shipped to Japan.

ENGINEERING MATERIALS HANDBOOK

JUST OUT! Gives answers by a number of specialists to both routine and specialized questions regarding the choice of engineering materials. Considers materials from the viewpoint of engineering structures, machinery, and equipment, and includes technical tables, design information, structural characteristics, etc. Emphasis is placed on the fabricated forms of materials. Edited by Charles L. Mantell, Consulting Engr.; Newark College of Engrg. 1906 pp., 648 illus., $21.50

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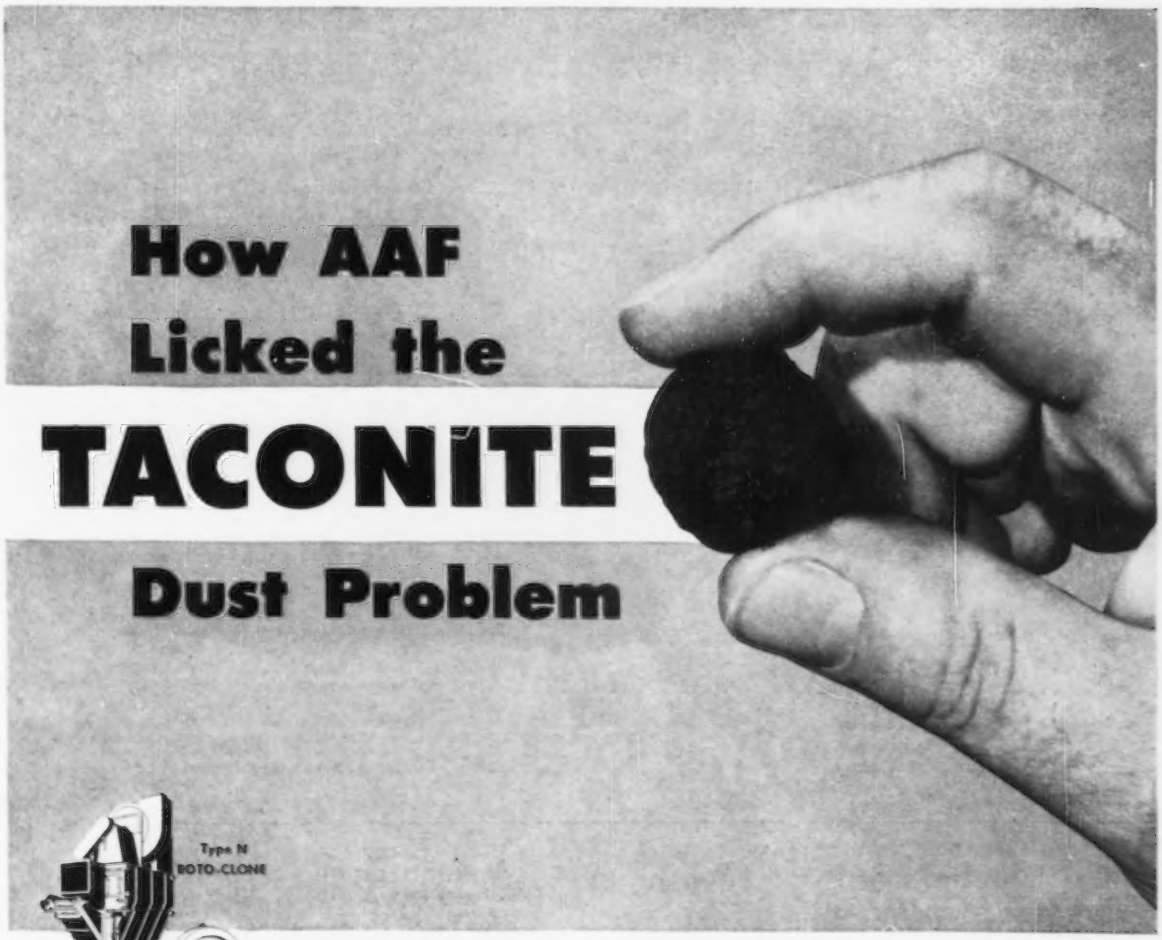

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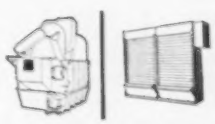

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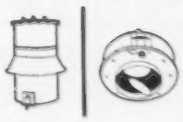

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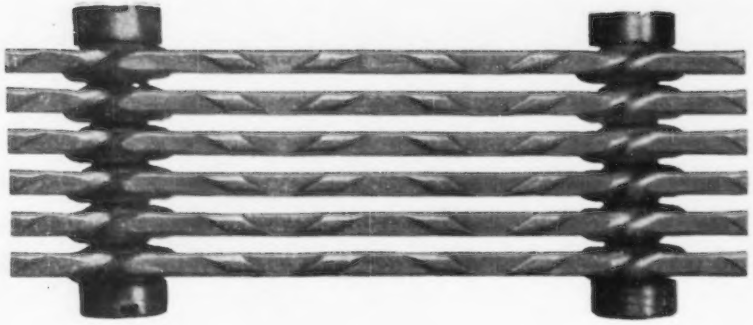

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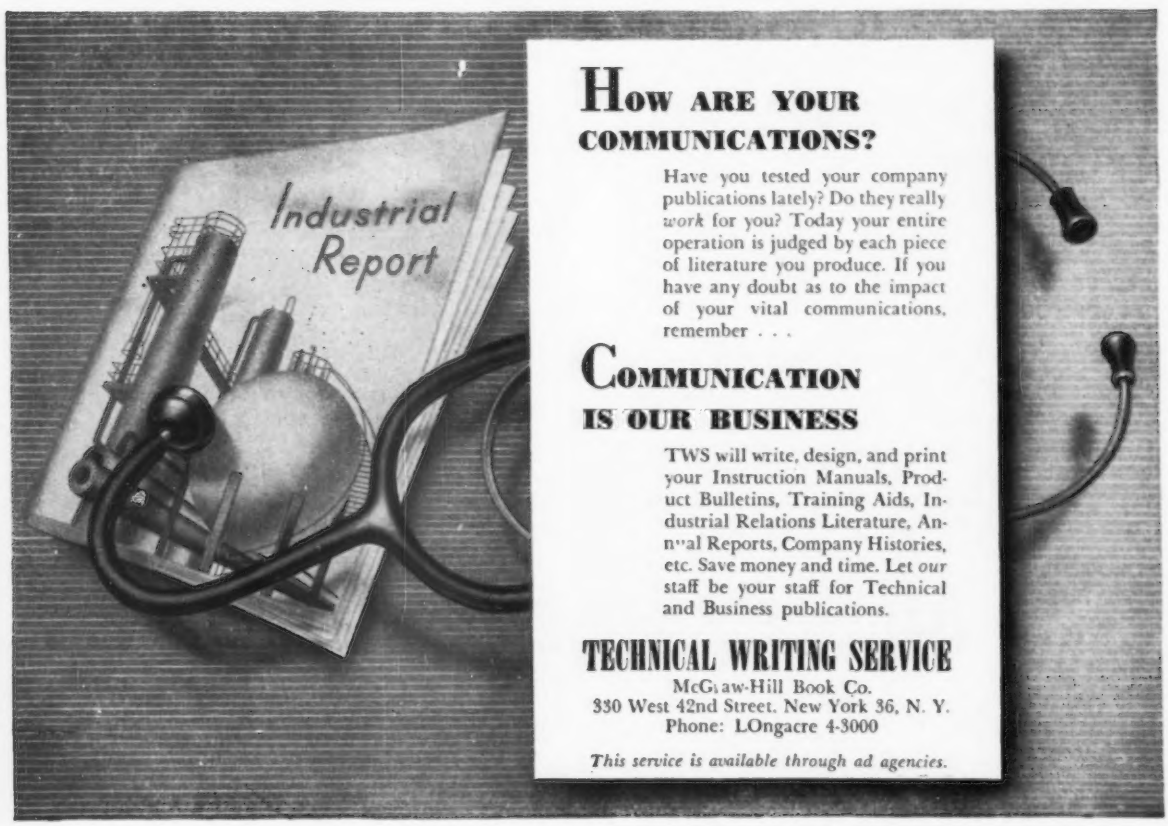

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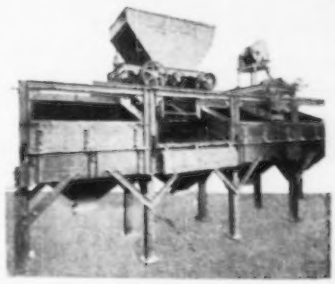

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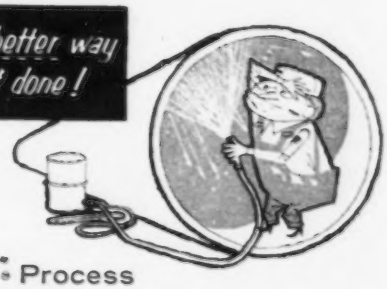

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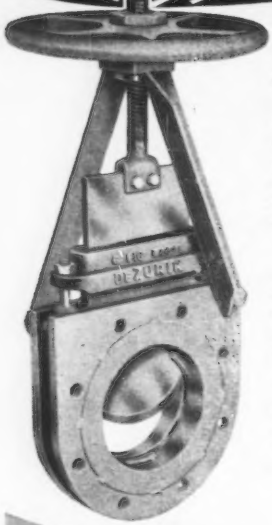

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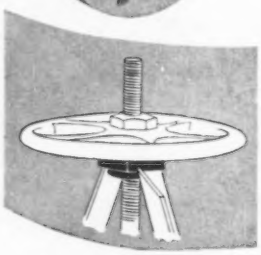

A large yoke head provides liberal bearing area for the operating nut. The 18-8 stainless steel stem has double-pitch threads for fewer turns of the hand-wheel and less wear on operating parts.

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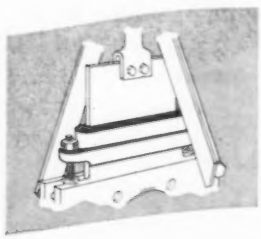

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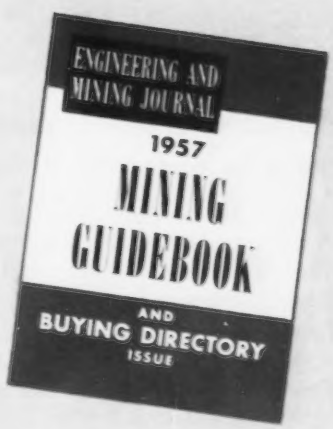

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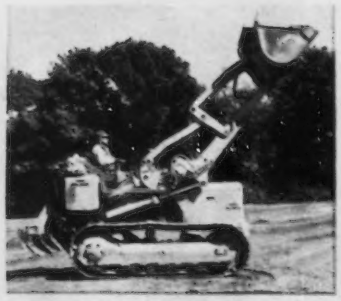
the TRAXCAVATOR'S  new...

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Side Dump Buckets Available for the No. 955 and No. 933 Traxcavators!

	No. 955	No. 933
Bucket capacity	1⅝ cu. yd.	1⅛ cu. yd.
Overall width of bucket	96"	86⅛"
Overall height, side dump	17' 5½"	15' 6 1/16"
Overall height, level	14' 6"	12' 11 1/16"
Left side dump reach	24½"	25½"

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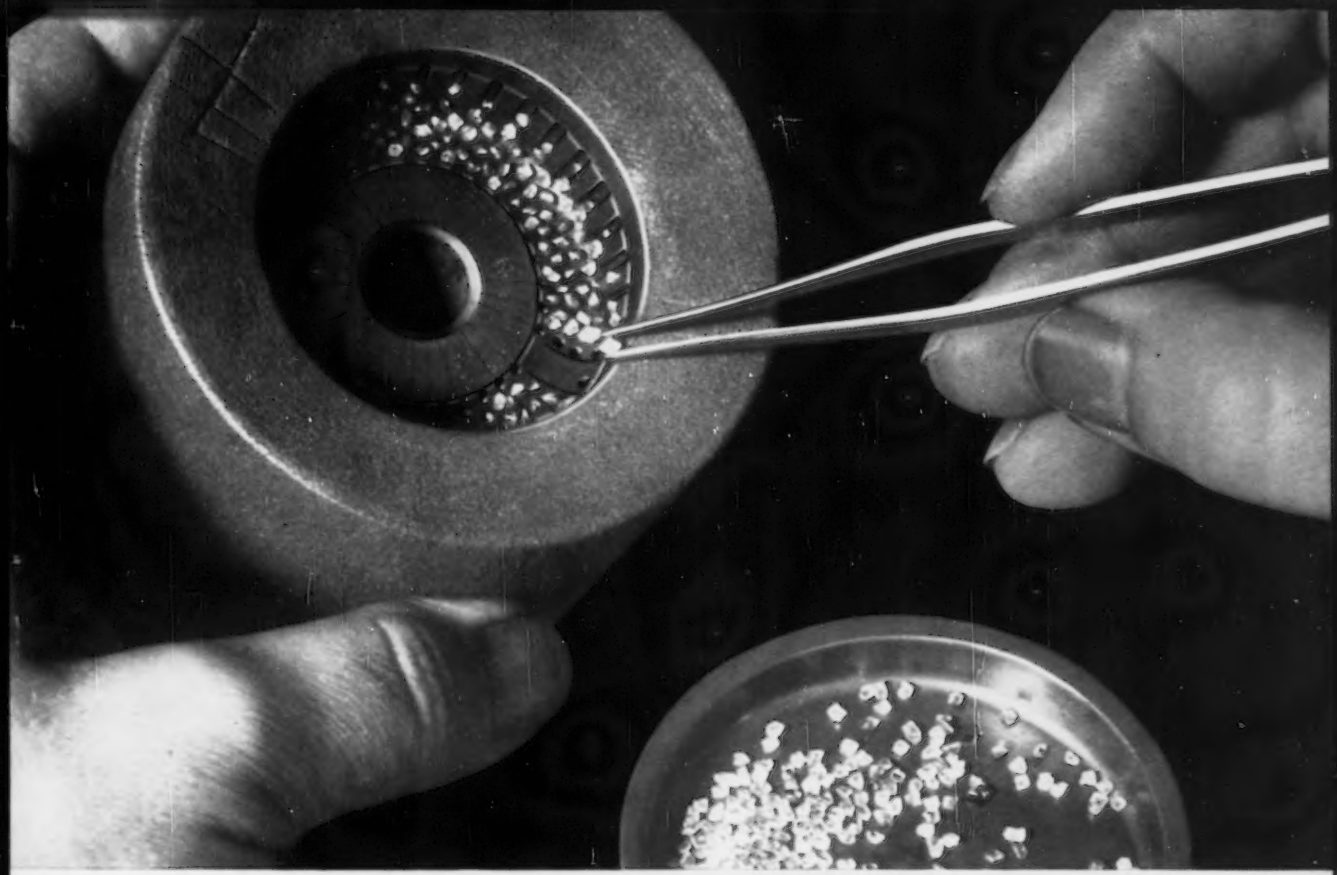
A NEW DIMENSION IN LOADER VERSATILITY



Two-Faced Diamonds help us cut your drilling costs

This diamond business sure is different! Here you see a shot of the operation known as "mechanical setting". Of course, the setter is setting the diamonds *by hand;* they *must* be set by hand because no machine yet devised has the ability to set diamonds with the "best face to the work" that gives you the better cutting power, longer cutting life and greater footage that you want.

Time was when the setter took the actual bit blank, scribed the pattern, drilled an individual hole for each diamond, set the diamond in, tapped it home, peened in the edges of the hole and, although the technique sounds primitive, turned out a pretty good bit. That was "hand setting".

Nowadays, he starts with a beautiful solid carbon mold in which the location of each diamond is a precisely spotted cavity. Into each cavity he sets the selected diamond and he still sets it "best face to the work".

This is called "mechanical setting" because it has the advantage of the precise carbon mold. But, for all this modern mechanization, it still has the all-important advantage of an expert eye and a practiced hand placing each diamond as it *must* be placed for top performance.

The Truco Bits resulting from this combination of mechanization, skill and experience demonstrate their superiority in faster cutting, greater footage, higher salvage, lower diamond cost. Try a Truco and see for yourself.

TRUCO DIAMOND BITS *by*

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America's leading industrial diamond importers for nearly half a century

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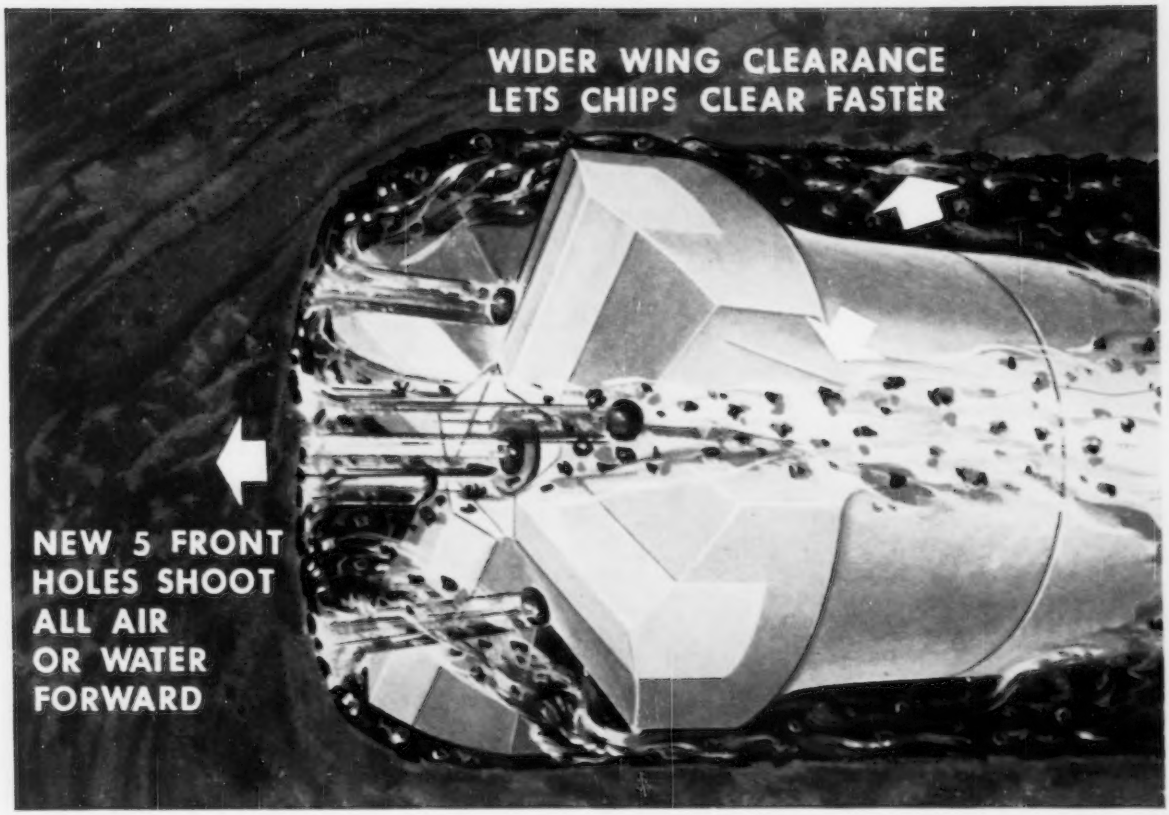
New TIMKEN® threaded bit spends less time "drilling" chips, more time drilling rock



The diagram above shows how the new Timken® threaded carbide bit spends less time "drilling" chips and more time drilling rock—gives you more hole-per-bit. That's because 1) the new Timken threaded carbide bit's newly positioned 5 front holes direct all air or water with jet-action against the rock face and 2) the deeper, wider wing clearance lets chips clear faster. And the deeper relief under the heel allows even more clearance for washed-back chips. This speedier chip removal ends the problem of clogged drill steels and protects bit skirts against damage.

You save even more because new special analysis carbides in the new Timken threaded bit give it greater wear-resistance with added shock-resistance. They can be reconditioned many times. The redesigned heavier wing helps drilling go faster. And the improved thread contact cuts breakage to the lowest point.

For more hole-per-bit on drifters, sinkers and stopers, use the new Timken threaded carbide bit. Write for free brochure that gives all details. The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable: "TIMROSCO".

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